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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey
MS 425 National Center
Reston, VA 22092

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

TRANSPORT PHENOMENA. - NEW EXPERIMENTAL RESULTS IN HYDRODYNAMICAL 'FORCED RAYLEIGH SCATTERING' (PHENOMENES DE TRANSPORT. - NOUVEAUX RESULTATS EXPERIMENTAUX EN DIFFUSION 'RAYLEIGH FORCEE' HYDRODYNAMIC),
Central Lab. of Mekorot (Israel).
L. Limat.
Comptes Rendus de L'Academie die Sciences, Serie II, Vol. 299, No. 8, p 391-394, 1984. 2 Fig, 5 Ref.

Descriptors: *Hydrodynamics, *Heat transfer, *Rayleigh scattering, Turbulent flow, Mathematical equations, Diffraction.

Temporal decrease of intensity diffracted by a phase grating in a flowing liquid was studied for spatial periods in the viscoconvective range. Turbulent transfers cause a relaxation of the mode of thermal fluctuations, which is followed with a laser diffracted by the index grating. The temperature modulation causes a modulation of the refractive index. The intensity is proportional to the temperature fluctuation spectrum. The decrease of intensity is plotted for different Reynolds numbers that characterize the Plane Poiseuille flow used. The decrease of intensity obeys an exponential law. When the flow is laminar, the time constant is the same as without flow. The values of p (the period) are in the viscoconvective range and the smallest structures impose their characteristic time on the convective transport of heat. (Moore-IVI)
W85-01745

1B. Aqueous Solutions and Suspensions

KINETIC FACTORS OF CACO3-PRECIPITATION AND THE PARTITIONING OF 12C AND 13C. STUDIES AT THE WATERFALLS OF GUTERSTEIN AND URACH (SCHWABISCHE ALB) (KINETISCHE FAKTOREN DER CACO3-ABSCHEIDUNG UND DER FRAKTIONIERUNG VON 12C UND 13C. UNTERSUCHUNGEN AN DEN WASSERFALLEN VON GUTERSTEIN UND URACH (SCHWABISCHE ALB)),
Goettingen Univ. (Germany, F.R.). Sedimentpetrographisches Inst.
J. Michaelis, E. Usdowski, and G. Menschel.
Zeitschrift fur Wasser und Abwasser Forchung, Vol. 17, No. 2, p 31-36, 1984. 8 Fig, 2 Tab, 22 Ref.

Descriptors: *Calcite, *Mineral springs, *Guterstein, *Urach, *West Germany, *Carbon radioisotopes, Bicarbonates, Carbon dioxide, Crystal growth, Degassing, Chemical kinetics, Wastewater pollution.

Measurements along the CaCO3-depositing spring of Guterstein demonstrate that calcite is not precipitated immediately from a Ca-bicarbonate solution. In a first step the solution degasses CO2. This causes the supersaturation to increase until crystallization begins at a CO3(2-) activity of about 0.000001 and Delta G about 1 kcal/mole. Due to degassing and precipitation the delta C-13 values of the dissolved carbonate increase systematically. The precipitated calcite should differ from the dissolved carbonate by Delta C-13 = 2.3 0/00 if isotopic equilibrium is attained. But, partitioning of the carbon isotopes does not occur because the solid is precipitated rapidly from a highly supersaturated solution. At the nearby spring of Urach the critical a CO3(2-) activity and Delta G-values are attained as well. But in contrast to an earlier period calcite does not precipitate at present. This is due, most probably, to inhibitors from waste water deposited in the recharge area. The delta C-13 values of the earlier calcite indicate recrystallization and isotopic re-equilibration. (Author's abstract)
W85-01662

SOLUBILITY OF ORGANIC MIXTURES IN WATER,
Syracuse Research Corp., NY. Life and Environmental Sciences Div.
For primary bibliographic entry see Field 5B.
W85-02109

EULERIAN-LAGRANGIAN SOLUTION OF THE CONVECTION-DISPERSION EQUATION IN NATURAL COORDINATES,
Geological Survey, Menlo Park, CA.
R. T. Cheng, V. Casulli, and S. N. Milford.
Water Resources Research, Vol. 20, No, 7, p 944-952, July, 1984. 7 Fig, 22 Ref.

Descriptors: *Convection, *Dispersion, *Eulerian-Lagrangian Method, Mathematical models, Mathematical equations, Anisotropic dispersion, Solute transport.

Numerical modeling of environmental fluid motions is beset by the conflicting advantages and disadvantages of the Lagrangian and Eulerian viewpoints. While the Lagrangian method follows the natural motions of the water mass, the Eulerian scheme has the major advantage of working in a fixed reference field. An algorithm is proposed for numerical solutions of the convection-disperison equations that combines the best properties of the Eulerian and Lagrangian methods. The Eulerian-Lagrangian Method (ELM) uses the Lagrangian concept in an Eulerian computational grid system. The Lagrangian concept gives a clear description of the conservation principles, the Eulerian concept provides a convenient working frame. The values of the dependent variable off the grid are calculated by interpolation. When a linear interpolation is used, the method is a slight improvement over the upwind difference method. At this level of approximation both the ELM and the upwind difference method suffer from large numerical dispersion. If second-order Lagrangian polynomials are used in the interpolation, the ELM is proven to be free of artificial numerical dispersion for the convection-dispersion equation. The concept of the ELM is extended for treatment of anisotropic dispersion in natural coordinates. The anisotropic properties of dispersion can be conveniently related to the properties of the flow field. the ELM is stable, accurate, and practical for use in the very long term simulation of transport processes in an environmental system. (Moore-IVI)
W85-02162

2. WATER CYCLE

2A. General

NEW ECOLOGICAL APPROACH TO THE WATER CYCLE: TICKET TO THE FUTURE,
Swedish Natural Science Research Council, Stockholm.
For primary bibliographic entry see Field 6A.
W85-01704

RECONNAISSANCE OF SURFACE WATER RESOURCES IN THE TOGIAK RIVER BASIN, SOUTHWESTERN ALASKA, 1980 AND 1982,
Geological Survey, Anchorage, AK. Water Resources Div.
D. R. Kernodle, R. R. Squires, and J. M. Childers.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4170, 1983. 24 p, 10 Fig, 6 Tab, 11 Ref.

Descriptors: *Surface water, Streamflow, Floods, Hydrology, *Water quality, *Benthic invertebrates, *Togiak River basin, *Alaska, Bristol Bay, Maximum evident floods, Environmental indicators.

Data collected during August and September 1980 and March 1982 describe hydrologic characteristics of the Togiak River and its tributaries. Surface waters are generally cold and clear, have significant wilderness recreation values, and provide outstanding salmon habitat. Late summer unit runoff ranged from 2.3 to 8.1 cubic feet per second per square mile. Stream width increased with discharge from about 20 feet on the tributaries to more than 300 feet on the Togiak River near its mouth. Mean depth increased with discharge downstream direction from about 1 to more than 4 feet. Mean velocity ranged between 1 and 4 feet per second and bore little relation to discharge. Late winter unit discharge for sites having little or no upstream lake storage was about 0.5 cubic foot per second per square mile. For the remaining sites, values ranged from 0.8 to 1.4 cubic feet per second per square mile. Unit runoff of maximum evident floods ranged from 12.9 to 50 cubic feet per second per square mile. Field measurements of water temperature, dissolved oxygen, pH, alkalinity and specific conductance indicated that water quality seems much the same throughout the basin and is influenced by the major lakes. Benthic invertebrates indicate a reasonably diverse fauna with midge larvae representing the largest percentage of all organisms found at most sites. (USGS)
W85-01777

IMPROVEMENT OF FLOOD-FREQUENCY ESTIMATES FOR SELECTED SMALL WATERSHEDS IN EASTERN KANSAS USING A RAINFALL-RUNOFF MODEL,
Geological Survey, Lawrence, KS. Water Resources Div.
R. W. Clement.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4110, 1983. 22 p, 2 Fig, 5 Tab, 21 Ref.

Descriptors: Surface water, *Floods, *Small watersheds, *Rainfall-runoff relationships, Precipitation, *Frequency analysis, Streamflow, Gaging stations, Model studies, Annual floods, Antecedent moisture, Surface runoff, Precipitation excess, *Flood frequency, *Kansas, Rainfall-runoff models, Skewness.

The U.S. Geological Survey rainfall-runoff model was used to estimate model parameters for 13 small watersheds in eastern Kansas with drainage areas of less than 11 square miles. Model parameters and rainfall data from three long-term rainfall stations were used in the model to synthesize long-term records of simulated annual peak discharge, which were fitted to a log-Pearson Type III distribution. Final estimates of T-year floods, which were computed by combining weighted estimates of the synthesized and observed T-floods, represent the most reliable estimates based on observed and long-term synthesized records of peak discharges. (USGS)
W85-01786

DROUGHT EFFECT ON HIGH-ALTITUDE FORESTS, RUAHINE RANGE, NORTH ISLAND, NEW ZEALAND,
Ministry of Works and Development, Napier (New Zealand). Water and Soil Div.
P. J. Grant.
New Zealand Journal of Botany, Vol. 22, No. 1, p 15-27, 1984. 7 Fig, 1 Tab, 32 Ref.

Descriptors: *Drought, *Ruahine Range, *New Zealand, *Forests, Rainfall, Deer, Soil erosion, Timberline, Temperature, Tree mortality, High altitude.

Shortly before 1917 abnormally high mortality of canopy trees occurred up to the timberline, c. 1470 m, in the central Ruahine Range. Rainfall records and historical observations indicate that this resulted from intense drought during 1914-15. Despite the drought damage and the impact of deer, the forest regenerated and after 1915 no major source area of coarse sediment developed in Centre Branch of the Waipawa Basin. Forest recovery at the head of the upper Waipawa Basin has produced a timberline which is c. 90 m lower than it was before 1915. On most of the Ruahine Range there is evidence of a recent lowering of timberline which probably also resulted from the 1914-15 drought and which is not associated with decrease of temperature. (Author's abstract)
W85-01886

EFFECTS OF CHANNEL EXCAVATION ON WATER-QUALITY CHARACTERISTICS OF THE BLACK RIVER AND ON GROUND-WATER LEVELS NEAR DUNN, NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
C. E. Simmons, and S. A. Watkins.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 82-4083, 1982. 28 p, 15 Fig, 4 Tab, 9 Ref.

Descriptors: *Channel improvement, *Water quality, *Groundwater levels, *North Carolina, Chemical analyses, Bank storage, Suspended sediment, Nutrients, Dissolved solids, Streamflow characteristics, Black River, Channelized streams, Water-table wells, Mean concentrations, Channel alterations.

During 1976-81 data were collected at three sites on the Black River near Dunn, N.C., to define the effects of channel excavation on stream quality and on ground-water levels in nearby areas. One of the data sites was located upstream from the five-mile long excavated reach and served as a background station. Changes in various characteristics of this Coastal Plain stream were determined by comparing data collected before, during, and after the construction period. After deepening of the channel by more than 2 feet, ground-water levels within 100 feet of the stream declined a proportionate amount; however, levels in a well 500 feet from the stream were unchanged. Flow velocities during channel deepening were 100 percent higher than velocities prior to construction. An average increase in water temperatures of about one degree Celsius was observed following removal of trees and brush that provided shading to the stream. After construction, concentrations of dissolved oxygen also increased. The percent of saturation increased 20 to 25 percent in the lower values. Maximum concentrations of suspended sediment increased from about 75 mg/L prior to construction to over 2000 mg/L during construction. Within a year after construction, levels of suspended sediment during stormflow had decreased but remained 5 to 10 times greater than preconstruction levels. Little or no change occurred in pH, total-dissolved solids, nitrogen, phosphorus, and bacteria. (USGS)
W85-01924

FLOOD-FREQUENCY ESTIMATES FOR FIVE GAGED BASINS IN WICHITA, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
C. A. Perry, and R. J. Hart.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 84-403, 1984. 23 p, 8 Fig, 6 Tab, 22 Ref.

Descriptors: *Rainfall-runoff relationships, *Model studies, *Frequency analysis, *Flood recurrence interval, *Urban runoff, Wichita, *Kansas, Gaged basins, Calibration.

A study of five basins within the city of Wichita, Kansas, describes the effects of varying degrees of urbanization on flood-frequency relationships. A rainfall-runoff model was calibrated for each basin with an average calibrated model error of 27.5 percent. The calibrated model synthesized 69 water years of peak-discharge record for each basin. Log-Pearson Type III flood-frequency analyses were performed on each synthesized record. Flood frequencies for each basin also were computed using a short-term record of observed annual peak discharges, the modified Soil Conservation Service method, the Oklahoma method, and the National method. The preferred method for computing flood frequency is dependent on the recurrence interval needed and the quantity of available data. Evaluation of all methods revealed the necessity of including a basin area-channel length factor for urban basins. An analysis of the effects of increasing imperviousness on peak discharges indicated an average factor of 6.3 between the 2-year rural and urbanized flood and an average factor of 2.3 between the 100-year rural and urbanized flood. (USGS)
W85-01949

BASIC CONCEPTS OF KINEMATIC-WAVE MODELS,
Geological Survey, Lakewood, CO. Water Resources Div.
J. E. Miller.
Available from the Distr. Br., USGS, 604 S. Pickett St., Alex., VA 22304. USGS Professional Paper 1302, 1984. 29 p, 10 Fig, 1 Tab, 39 Ref.

Descriptors: *Flow routing, *Kinematic wave models, Dynamic waves, Rivers, Watersheds, *Open channel flow, Unsteady flow, *Model studies.

The kinematic-wave model is one of a number of approximations of the dynamic-wave model. The dynamic-wave model describes one-dimensional shallow-water waves (unsteady, gradually varied, open-channel flow). The report provides a basic reference on the theory and application of kinematic-wave models and describes the limitations of the model in relation to the other approximations of the dynamic-wave model. In the kinematic-wave approximation, a number of the terms in the equation of motion are assumed to be insignificant. The equation of motion is replaced by an equation describing uniform flow. Thus, the kinematic-wave model is described by the continuity equation and a uniform flow equation such as the well-known Chezy or Manning formulas. Kinematic-wave models are applicable to overland flow where lateral inflow is continuously added and is a large part of the total flow. For channel-routing applications, the kinematic-wave model always predicts a steeper wave with less dispersion and attenuation than actually occurs. The effect of the accumulation of errors in the kinematic-wave model shows that the approximations made in the development of the kinematic-wave equations are not generally justified for most channel-routing applications. Modified flow-routing models can be used which help to stop the accumulation of error that occurs when the kinematic-wave model is applied. (USGS)
W85-02035

CALIBRATION AND VERIFICATION OF A RAINFALL-RUNOFF MODEL AND A RUNOFF-QUALITY MODEL FOR SEVERAL URBAN BASINS IN THE DENVER METROPOLITAN AREA, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
J. B. Linder-Lunsford, and S. R. Ellis.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4286, 1984. 52 p, 6 Fig, 26 Tab, 7 Ref.

Descriptors: *Model studies, *Urban runoff, *Water quality, *Colorado, Denver, Jefferson County, Arapahoe County, Adams County, Denver County.

The U.S. Geological Survey's Distributed Routing Rainfall-Runoff Model--Version II was calibrated and verified for five urban basins in the Denver metropolitan area. Land-use types in the basins were light commerical, multifamily housing, single-family housing, and a shopping center. The overall accuracy of model predictions of peak flows and runoff volumes was about 15 percent for storms with rainfall intensities of less than 1 inch per hour and runoff volume of greater than 0.01 inch. Predictions generally were unsatisfactory for storm having a rainfall intensity of more than 1 inch per hour, or runoff of 0.01 inch or less. The Distributed Routing Rainfall-Runoff Model-Quality, a multievent runoff-quality model developed by the U.S. Geological Survey, was calibrated and verified on four basins. The model was found to be most useful in the prediction of seasonal loads of constituents in the runoff resulting from rainfall. The model was not very accurate in the prediction of runoff loads of individual constituents. (USGS)
W85-02044

NASH MODEL RELATION TO HORTON ORDER RATIOS,
R. Rosso.
Water Resources Research, Vol. 20, No. 7, p 914-920, July, 1984. 11 Fig, 3 Tab, 18 Ref.

Descriptors: *Hydrologic models, *Catchments, Model studies, Streamflow, Velocity, Rainfall-runoff relationships, Storms.

The Nash model of the instantaneous unit hydrograph (IUH) is parameterized in terms of Horton order ratios of a catchment on the basis of a geomorphologic model of catchment response. The shape parameter of the Nash model is dependent on Horton's numbers R sub-A, R sub-B, and R sub-L, of a catchment. Therefore catchment geomorphology can provide a synthesis of the shape of the hydrologic response. The scale parameter of the Nash model results to be a time varying character depending on both geomorphology and average streamflow velocity along the stream network. These two factors are taken separately into account. The assumption of a constant response function for a catchment is therefore related to the assumption of a constant time scale of the IUH for the Nash model of catchment response. Since the IUH can be a time-varying characteristic, both throughout the storm and for different storms, this variability could be accounted for by the variability of the time scale of the IUH. Therefore the time scale of the IUH could account for the variabiliy of the hydrologic response for different storms and throughout a storm. When compared with traditional regression formulae, these findings can substantially improve the prediction capability of the Nash model for catchments where no direct rainfall runoff analysis can be performed. (Baker-IVI)
W85-02158

ESTIMATION OF SKEWNESS OF HYDROLOGIC VARIABLES,
George Washington Univ., Washington, DC. International Water Resources Inst.
V. Yevjevich, and J. T. B. Obeysekera.
Water Resources Research, Vol. 20, No. 7 p 935-943, July, 1984. 12 Fig, 3 Tab, 21 Ref. NSF grant CEE-7916817.

Descriptors: *Skewness, *Hydrology, Probability, Mathematical studies, Simulation.

Various methods of estimation of the skewness coefficient of hydrologic random variables are compared with respect to bias, variance, mean square error, and robustness. The underlying population distributions are limited to gamma (Pearson type 3) and lognormal. The simulation results show that a new skewness estimator that uses the estimated covariance between the subsample mean and the subsample variance has a lesser bias than the ordinary skewness estimators. It may be used as a surrogate when the sample size is small and population skewness large. The superior estimates of skewness resulting from the maximum likelihood estimation of parameters of the known underlying distribution and robustness studies point to the importance of the correct inference on the type of underlying probability distribution function in hydrologic applications. (Author's abstract)
W85-02161

ADDITIONAL TESTS ON THE EFFECT OF RAINFALL INTENSITY ON STORM FLOW AND PEAK FLOW FROM WILD-LAND BASINS,
Georgia Univ., Athens. School of Forest Resources.
For primary bibliographic entry see Field 2E.
W85-02166

2B. Precipitation

DROUGHT IN SOUTHEASTERN UNITED STATES,
Florida Univ., Gainesville. Dept. of Geography.
J. A. Henry, and S. E. Dicks.
Florida Scientist, Vol. 47, No. 2, p 114-129, Spring, 1984. 10 Fig, 1 Tab, 17 Ref.

Descriptors: *Drought, *Florida, *Georgia, *North Carolina, *South Carolina, *Tennesse, *Alabama, *Mississippi, Moisture deficiency, Weather patterns, Climatology, Eigenvector analysis, Palmer Drought Index.

Drought has been a significant, if not dominant, meteorological factor in the southeastern United States (Florida, Georgia, North Carolina, South Carolina, Tennesse, Alabama, and Mississippi) in recent years. Eigenvector analysis of Palmer Drought Index values for southeastern United States for 1931-79 reveals that the 1930s and 1950s experienced the most significant droughts. Generally, the dry conditions in the Southeast were less severe than those of the Midwest at the same time. Throughout the 1960s, conditions were generally normal to wet, with significant drought only in central and southern Florida. The 1971-79 period was significantly wetter than normal in nearly all of the Southeast. Moisture conditions in south-central and southern Florida are generally out of phase with the remainder of southeastern United States. (Collier-IVI)
W85-01642

REVIEW OF RAINFALL DATA APPLICATION FOR DESIGN AND ANALYSIS,
VIAK Consultants, Linkoeping (Sweden).
V. Arnell, P. Harremoes, M. Jensen, N. B. Johansen, and J. Niemczynowicz.
Water Science and Technology, Vol. 16, No. 8/9, p 1-45, 1984. 14 Fig, 4 Tab, 161 Ref.

Descriptors: *Rainfall, *Data processing, *Model studies, *Rainfall-runoff relationships, Design storms, Statistical analysis, Computer models, Computer studies, Storms, Floods, Prediction.

The introduction of computer technology has made it possible to handle quantities of data unheard just decades ago. Rain data is a good example of such masses of data that have become available for statistical analysis. The state of the art within the following areas was reviewed: 1) the statistical characterization of rainfall in time and space, 2) the development of synthetic design storms and, 3) the application of both synthetic design storms and historical storms to pipe design, flooding prediction, design of detention basins and calculation of the yearly or extreme pollutional load on receiving waters from combined sewer overflows. The main conclusion, primarily related to item 3, is that more attention in this context should be put on statistical analysis of flooding and pollution. This analysis is best performed by applying historical rain records. Realistic flooding prediction is believed only to be possible with a fully dynamic flow model, whereas pollution may be studied by means of simpler models like the time area approach. The outstanding problem in statistical prediction is the distribution in space of the historical rains. (Collier-IVI)
W85-01677

DESIGN STORM FOR A TROPICAL LOCATION WITH LIMITED DATA,
Hydraulics Research Station, Wallingford (England).
P. J. Colyer.
Water Science and Technology, Vol. 16, No. 8/9, p 63-68, 1984. 4 Fig, 2 Ref.

Descriptors: *Design storms, *Model studies, *Urban drainage, *Tropical regions, *Trinidad, *Port of Spain, Urban watersheds, Rainfall intensity, Rainfall-runoff relationships, Rainstorms, Intensity-duration-frequency curves.

A computational model was produced of the improved urban storm drainage system of Port of Spain, Trinidad. Locally appropriate rainfall data were developed by first producing relationships between rainfall intensity, duration, and frequency (IDF) and then determining design storm profiles. Rainfall depths were obtained from an existing IDF. Design storm profiles were based on analysis of 100 storms recorded on two raingauges over a two year period (1980 and 1981). A clear tendency to advanced skewness in the profiles was discovered; well over 50% of the rainfall depth occured in the first half of the storm. For the purposes of storm drainage analysis, the 100 storms could be divided into three types: a 'Diego Martin' type with very marked skewness and uneven distribution of intensity; a 'San Juan' type with less marked skewness; and a uniform intensity distribution. The computer programs were constructed to use values of the ratio Instantaeous intensity/Mean intensity at 1% time intervals through the storm duration. These ratios were combined with a mean intensity from the IDF relationship to give a dimensional storm profile. The surface runoff model developed for urban conditions in Trinidad was calibrated using observed rainfall and runoff events. The calibrated model was then used within the design storm profiles described above to examine the behavior of the existing drainage system in Port of Spain and to design the necessary improvements. (Collier-IVI)
W85-01678

SYNTHETIC DESIGN STORM AND ITS RELATION TO INTENSITY-DURATION FREQUENCY CURVES,
Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia). Dept. of Sanitary Engineering.
P. Urcikan, and J. Horvath.
Water Science and Technology, Vol. 16, No. 8/9, p 69-83, 1984. 8 Fig, 3 Tab, 10 Ref.

Descriptors: *Czechoslovakia, *Design storms, *Intensity-duration-frequency Curves, *Model studies, *Rainfall distribution, Rainstorms, Urban hydrology, Rainfall-runoff relationships.

New hydrodynamic deterministic models of rainfall-runoff processes in urban hydrology contributed significantly to development of statistical processing of natural rainfall as synthetic design storms. Design rainfalls have been applied in current hydrodynamic rainfall-runoff models; the course of design rainfalls may be simulated by means of several stochastic-mathematical models. Methods applied in developing design storms with optional time position of intensity maximum with increasing and decreasing intensity course, expressed by means of exponential equations were analyzed. The medium value of the intensity maximum time position tmax/td = 0.317 was identified in eight recording raingauge stations from the set of actual rainfalls of a five-year evaluation period. The design storms will be applied in the future in Czechoslovakia in cases where a more reliable design storm with a variable intensity course, having a character of a stochastic design storm cannot be obtained. (Collier-IVI)
W85-01679

STATISTICAL METHODS OF STORM ANALYSIS,
Agricultural Research Service, Beltsville, MD. Hydrology Lab.
V. D. Vukmirovic, and J. Z. Despotovic.
Water Science and Technology, Vol. 16, No. 8/9, p 85-92, 1984. 8 Fig, 7 Ref.

Descriptors: *Intensity-duration-frequency Curves, *Model studies, *Rainfall distribution, *Rainstorms, Urban hydrology, Storms, Rainfall-runoff relationships, Rainfall intensity, Urban runoff.

Complex information concerning small duration high intensity rainfall is useful for both hydrologist and design engineer and also necessary for urban run-off calculations and drainage system analysis. Return period for a rainfall depth could be determined by an analysis of the annual maxima sample rainfalls for a given duration. That analysis consists of the following three methods: annual maxima method, peaks over threshold method (POT is known as 'partial duration series'), and compound POT. For the defined duration D, relations among D, return period R and rainfall depth X can be evaluated; if there is a need for some more information, it is necessary to analyze the rainfall intensity variations during a rainfall. The storm pattern itself is a random variable that can be defined by a two-dimensional distribution function from which a synthetic storm pattern could be obtained. The distribution function could be interpreted as the probability of a pattern shape appearance. A date in a year when annual maxima Xmax of given duration appears is a random variable d; its distribution function can be defined. The recorded data could be used for the random variable d, transforming the dates into numbers from 1 to 365. This sample could be used for an annual maxima method analysis. An analysis consisting of all three above methods was applied to 57 years of record rainfall data covering the period 1925 to 1981. The annual maxima method was the most simple and the results of this method could be evaluated rapidly. The compound POT method takes more time to get complete information about the storm. (Collier-IVI)
W85-01680

SOME STATISTICAL PROPERTIES OF SHORT-DURATION RAINFALL,
Belgrade Univ. (Yugoslavia). Faculty of Civil Engineering.
D. M. Hershfield.
Water Science and Technology, Vol. 16, No. 8/9, p 93-100, 1984. 10 Fig, 5 Ref.

Descriptors: *Rainfall distribution, *Model studies, *Rainstorms, Urban hydrology, Storms, Rainfall-runoff relationships, Rainfall intensity.

Information on the nature of rainfall characteristics in time and space associated with storms in the mid-latitudes is indispensable for the cost-effective design of various hydraulic structures. Examination of storm data and climatological quantities from both dense raingage networks and individual stations in the United States elucidated some of the important problems in developing drainage design criteria for small areas. Using 5-min increments, for hundreds of storms, the average of the maximum 5-min values was determined to be about 40% of the 60-min amount. The rates of the incoming storm rainfall can vary greatly over a small area but the cumulations during the storm period tend to equalize the storm totals. An 'average' time distribution curve was developed along with relationships between rainfall amounts for durations from 2- to 60-min. A procedure was used for estimating and comparing six quantities from series of annual maximum rainfalls for several short durations. The quantities included a frequency factor, 100-yr value, the probable maximum rainfall, and the observed world maximum rainfalls. (Collier-IVI)
W85-01681

RAINFALL AS THE BASIS FOR URBAN RUNOFF - EXPERIENCE AND PRACTICE IN YUGOSLAVIA,
Split Univ. (Yugoslavia). Faculty of Engineering.
O. Bonacci.
Water Science and Technology, Vol. 16, No. 8/9, p 101-108, 1984. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Rainfall distribution, *Urban runoff, *Yugoslavia, *Rainfall-runoff relationships, Model studies, Rainstorms, Intensity-Duration-Frequency curves, Urban hydrology, Storms, Rainfall intensity, Discharge hydrographs, Hydrographs.

The objective of each study of intensive rainfall and its further application in runoff processes is to define intensity-duration-frequency (IDF) curves. When reading pluviograph records the maximum values of all types of rainfall, regardless of the intervals occuring in intensive rainfall, should be taken into account. In choosing between the partial duration series, annual maxima series, or peaks over a threshold (POT) series, theoreticians prefer the POT series, whereas engineers in practice mostly avoid it. The application of the POT series is more complex than other types of series as it poses certain constraints related to the distribution of occurences of peaks higher the threshold value H sub b. IDF curves should be plotted by defining two families of IDF curves, the first for the period ranging from 5 min to 60 or 120 min and the second for the period from 60 or 120 min up to 24 hours; this method should be used as opposed to plotting for the period ranging from 5 min to 24 hours. In Yugoslavia there are about 250 pluviographs and 3000 rain gauge stations with daily data recordings over an area covering 255,804 sq km.

High variability and significant changes in characteristics of intensive rain in space and time, particularly the direction of storm movement, significantly affect the formation of runoff processes, i.e. outflow hydrograph. The genetic method for computing the runoff process should be used based on the definition of isochrones applied to dynamic programming. (Collier-IVI)
W85-01682

DEPTH-DURATION MODELS OF SHORT TIME INCREMENT RAINFALL,
Purdue Univ., Lafayette, IN. Dept. of Civil Engineering.
A. R. Rao, and B. T. Chenchayya.
Water Science and Technology, Vol. 16, No. 8/9, p 109-130, 1984. 9 Fig, 5 Tab, 10 Ref.

Descriptors: *Depth-area-duration analysis, *Urban runoff, *Rainfall-runoff relationships, Rainfall intensity, Model studies, Rainfall distribution, Rainstorms, Urban hydrology, Storms.

The short increment rainfall depth values corresponding to given frequencies and durations are frequently used in urban storm drainage design. The depth-duration characteristics of short time increment (10 min. and hourly) rainfall sequences, and proposed models of the depths and durations, were investigated as was the effect of different time scales on modelling the process. Regression models of depth and duration data as well as bivariate gamma distribution were used for analysis of hourly and 10-minute rainfall measured at Lafayette, Indiana. Regression models for storm depth-duration relationship are adequate when they are used with appropriately classified storms. Significant differences and some surprising similarities were found in the characteristics of short time increment rainfall processes in different climatic regions. The characteristics of the 10 minute and hourly data are quite similar to each other. (Collier-IVI)
W85-01683

RAINFALL EVENTS AS PATHS OF A STOCHASTIC PROCESS: PROBLEMS OF DESIGN STORM ANALYSIS,
Technische Univ., Munich (Germany, F.R.). Lehrstuhl und Pruefamt fuer Wassergutewirtschaft und Gesundheitsingenieurwesen.
J. Brummer.
Water Science and Technology, Vol 16, No. 8/9, p 131-138, 1984. 1 Fig, 2 Tab, 4 Ref.

Descriptors: *Rainfall, *Stochastic process, *Design storms, Rainfall-runoff relationships, Rainfall intensity, Catchment area, Flood peak.

For questions of temporal and spatial intensity distribution of precipitation events, frequency of precipitation characteristics and for the construction of representative rainstorm events (design storm analysis), a survey of the distribution of completed rainfall events is sufficient. Of interest are the possible variability patterns of rainfall events and their probability distribution (relative frequency of appearance). A concept is introduced for approximating natural peak flow value by means of the distribution of typical rainfall patterns. A comparison demonstrates the quality of this concept and the competency of some well-know design storms for the adequate evaluation of peak flows. The approximation of the natural values by the value resulting from the weighted rainfall patterns, succeeds well for relatively small catchment areas. A slight, continuously increasing underestimation of the natural values begins only in the areas with more than 100 ha of total surface. (Moore-IVI)
W85-01684

UNIVARIATE VERSUS MULTIVARIATE RAINFALL STATISTICS - PROBLEMS AND POTENTIALS,
Hanover Univ. (Germany, F.R.). Inst. fuer Wasserwirtschaft, Hydrologie und Landwirtschaftlichen Wasserbau.
W. Schilling.
Water Science and Technology, Vol. 16, No. 8/9, p 139-146, 1984. 10 Fig, 3 Ref.

Descriptors: *Urban hydrology, *Rainfall, *Statistics, *Multivariate analysis, Mathematical studies, Design storms, Rainfall distribution.

Problems of conventional (univariate) rainfall statistics are discussed. Advanced problems in urban hydrology include design of detention reservoirs, computation of pollution loads and other features. For each of these tasks the conventional statistical treatment of rainfall data causes particular problems since hydrographs rather than peak flows are relevant for the final result. Implications of rainfall probability on probability of reservoir failure or pollution loads are extremely unreliable. Similar problems occur if a design storm is to be defined, because conventional rainfall statistics do not provide any rule how to order a sequence of rainfall intensities. A multivariate approach is presented which treats rainfall as a sequence of independent events, takes care of the temporal structure and eventually also takes care of the spatial structure of rainstorms. (Baker-IVI)
W85-01685

STOCHASTIC CHARACTERIZATION OF TEMPORAL STORM PATTERNS,
Quebec Univ., Chicoutimi. Dept. des Sciences Appliquees.
V. T. V. Nguyen.
Water Science and Technology, Vol. 16, No. 8/9, p 147-153, 1984. 4 Fig, 1 Tab, 10 Ref.

Descriptors: *Model studies, *Rainstorms, *Rainfall distribution, Probability distribution, Montreal, Quebec, Storms, Precipitation.

A general stochastic model for characterizing the temporal pattern of storms was developed which can take into account both the persistence in hourly rainfall occurences and the dependence between successive hourly rainfall depths; a storm is defined as a continuous run of non-zero one-hour rainfall depths. The model determines the probability distributions of cumulative storm rainfall amounts at successive time intervals after storm the begins. Hourly rainfall data from Dorval Airport station, on the Island of Montreal, for a total of 2560 summer rainfall events having durations of from 1 to 27 hours were selected from a 32-year record (1943-1974) according to the definition of a storm specified above. The serial correlation coefficient was assumed to be stationary and its computed sample values were used in the estimation of the probability distribution functions for cumulative rainfall amount. By accounting for the correlation structure of consecutive rainfall depths the model gives a good fit to the observations. Use of the model for analytically constructing distributions of cumulative rainfall amounts at successive time intervals seems preferable to the simulation or fitting approaches that have been used in previous investigations. (Collier-IVI)
W85-01686

TIME PATTERNS OF RAINFALL FOR ESTIMATING DESIGN FLOODS ON A FREQUENCY BASIS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
I. Cordery, D. H. Pilgrim, and I. A. Rowbottom.
Water Science and Technology, Vol. 16, No. 8/9, p 155-165, 1984. 3 Fig, 3 Tab, 6 Ref.

Descriptors: *Rainfall, *Design floods, *Rainfall distribution, Frequency distribution, Floods, Urban hydrology, Model studies, Flood peak, Maximum probable floods.

The rainfalls used in the practical estimation of design floods are generally based on frequency-duration relationships derived from recorded intense bursts of rainfall of various durations rather than from complete storms. These recorded intense bursts are therefore used in the derivation of the temporal patterns. The method produces patterns that incorporate the average variation of intensities and the most likely sequence of these varying intensities. Use of these patterns should minimize the introduction of joint probabilities into the design flood model and aid in estimation of a flood with the same frequency as the design rainfall. The method provides patterns with average or typical variations in intensity, in contrast to simple averaging which is shown to be generally unlikely to yield satisfactory patterns. The derived patterns are shown to provide peak flood estimates which are higher than those given by constant intensity storms but lower than rearrangements of the frequency-duration relationships. (Author's abstract)
W85-01687

TEMPORAL DISTRIBUTION OF DESIGN STORM RAINFALL,
National Water Research Inst., Burlington (Ontario).
J. Marsalek.
Water Science and Technology, Vol. 16, No. 8/9, p 167-175, 1984. 3 Fig, 19 Ref.

Descriptors: *Design storms, *Rainfall distribution, *Simulated rainfall, Rainstorms, Rainfall simulators, Urban hydrology, Rainfall-runoff relationships, Runoff forcasting.

The temporal distribution of rainfall intensity is one of the most important characteristics of the design storm. This distribution, and in particular its peak intensity and the peak timing, significantly affect the runoff peaks simulated for small urban catchments of significant imperviousness. Various methods for the development of design storm temporal distributions, recommended in the literature, produce widely varying temporal distributions. Such differences in design storm hyetographs can be noticed for the peak magnitude and timing as well as for the overall distribution. Some methods may even produce different rainfall depths for identical return periods and durations. As a consequence of differences in design hyetographs, the simulated runoff peaks will differ as well. The extent of variations in runoff peaks simulated for various design hyetographs will be affected by the catchment response and the selected rainfall interval and the computaional time step. Further comparative studies and exchange of experience are recommended. (Collier-IVI)
W85-01688

EFFECT OF SPATIAL RAINFALL DISTRIBUTION ON SEWER FLOWS,
Hanover Univ. (Germany, F.R.). Inst. fuer Wasserwirtschaft, Hydrologie und Landwirtschaftlichen Wasserbau.
For primary bibliographic entry see Field 2E.
W85-01689

AREAL REDUCTION FACTORS ON SHORT TIME AND SPACE INTERVALS,
Montpellier-2 Univ. (France). Lab. d'Hydrologie Mathematique.
M. Desbordes, P. Raous, and Y. Trevisiol.
Water Science and Technology, Vol. 16, No. 8/9, p 189-198, 1984. 3 Fig, 4 Tab, 3 Ref.

Descriptors: *Areal precipitation, *Rainfall-runoff relationships, *Rungis, *France, Rainfall intensity, Drainage area, Intensity-duration-frequency curves.

In most research studies on rainfall-runoff processes, rainfall intensities over the experimental catchments are measured by means of a few raingages. An experimental dense raingage network on the Rungis catchment, France, composed of 9 raingages, covering approximately 300 to 400 hectares, was monitored for three years. Areal reduction factors on short time and space intervals were determined from 51 events ranging from 5 minutes to 4 hours. Mean rainfall intensities should not be considered to be uniformly distributed over small areas ranging from 100 to 400 hectares and for durations less than one hour. For storm drainage design purposes, one should remember that areal reduction factors are random variables; the areal distribution of rainfall should be taken into account be means of Areal Intensity-Duration-Frequency curves. If these are unknown, one should use mean areal reduction factors defined from point rainfall, rather than mean reduction factors which are defined from maximum point rainfall, observed over

a given area. Rainfall-runoff balances at the catchment outlet have confirmed the influence of raingage network density. The minimum 50 to 100 hectares mesh size seems to be suitable. (Collier-IVI)
W85-01690

NORWEGIAN ACTIVITIES ON COLLECTION AND RESEARCH ON RAINFALL DATA,
Norsk Inst. for Vannforskning, Oslo.
O. Lindholm.
Water Science and Technology, Vol. 16, No. 8/9, p 199-205, 1984. 4 Fig, 1 Ref.

Descriptors: *Norway, *Rainfall distribution, *Rainfall intensity, Pluviographs, Rain gages, Data collection, Hydrologic data, Area reduction factors.

Many Norwegian communities are located near mountains, valleys, and hills; this topologic diversity caused very big variations in rain intensity from place to place. Due to this condition, a network of monitoring stations for monitoring short-time precipitation is required. There are ca. 50 tipping bucket pluviographs in Norway recording on magnetic tape. These pluviographs (called PLUMATIC) are maintained by the Norwegian Meteorological Institute (MI) which also process the data-tapes and distributes information and results from the stations. Spatial rainfall distribution was compared with point measurements based on 5 years of data from 6 PLUMATICS in the Oslo area The area reduction factor calculated from this data decreased rapidly up to 10 sq km and a further increase in this area gives a much slower decrease in the reduction factor. (Collier-IVI)
W85-01691

DESIGN INFLOW INTENSITY AND DESIGN INFLOW PROFILES FOR STORM SEWERS,
Rijksdienst voor de Ijsselmeerpolders, Lelystad (Netherlands).
For primary bibliographic entry see Field 2E.
W85-01692

EVALUATION OF URBAN DESIGN STORM SENSITIVITY,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
H. G. Wenzel, Jr., and M. L. Voorhees.
Water Science and Technology, Vol. 16, No. 8/9, p 219-236, 1984. 6 Fig, 6 Tab, 20 Ref. Office of Water Resources and Technology project A-095-ILL.

Descriptors: *Design storms, *Urban drainage, *Drainage systems, Design criteria, Rainfall distribution, Drainage, Urban hydrology, Storm sewers, Depth-duration-frequency analysis, Frequency analysis.

Traditionally, in the design process for urban drainage systems, a precipitation event, either historical or artificial, is identified and the system under study is designed to accommodate that event. This event is usually selected on the basis of a target return period. It is then assumed that the probability of the design capacity being exceeded is the same as the probability of the magnitude of the design storm being exceeded. The sensitivity of the frequency response of three catchments to design storm parameters was examined; parameters included hyetograph shape, antecedent soil moisture condition (AMC), and rainfall duration. A continuous simulation model was used to compute simulated historical frequency responses for three different long term rainfall records. Design storms were also developed from depth-duration-frequency analysis of the rainfall data; comparisons were made on frequency graphs. The hyetograph used for the design storm can significantly affect the return period of the resulting design. AMC can have as much affect on the frequency response of peak flows as hyetograph shape. The time of concentration of the catchment serves as a good guide to determine the duration of the design storm to be used. Significant parameter sensitivity exists but an appropriate choice of design storm parameters can produce a design which yields peak flows of the desired return period. (Collier-IVI)
W85-01693

STAGED APPROACH TO APPLICATION OF RAINFALL DATA TO URBAN RUNOFF CALCULATIONS,
Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.
For primary bibliographic entry see Field 2E.
W85-01694

RAINFALL DATA FOR THE DESIGN OF DETENTION BASINS,
VIAK Consultants, Linkoeping (Sweden).
For primary bibliographic entry see Field 2E.
W85-01695

RAINFALL ENERGY FROM DROP SIZE DATA,
Pittsburgh Univ., PA. Dept. of Civil Engineering.
R. G. Quimpo, and A.-B. Brohi.
Water Science and Technology, Vol. 16, No. 8/9, p 271-283, 1984. 5 Fig, 2 Tab, 25 Ref.

Descriptors: *Rainfall energy, *Fluid drops, *Kinetic energy, *Erosion rates, Precipitation intensity, Storms, Rainfall intensity.

With the availability of raindrop size distribution data, it is now possible to examine the energy content of storms and approximate more closely their erosion potential. The washoff of pollutants from urban surfaces by storm events depends on the kinetic energy of storms. In order to determine the erosive power of rainfall, data on raindrop size distributions were analyzed and the kinetic energy was expressed as a function of rainfall intensity. Because rainfall intensities vary during the storm, the energy should be calculated from the varying drop size distribution during the storm rather than from the extrapolated distribution from short duration sampling. The regression equation that is currently used to determine storm erosive power from rainfall intensity needs to be revised. (Collier-IVI)
W85-01696

OVERFLOW DATA OF RAINWATER DISCHARGE SYSTEMS DETERMINED FROM RUN OFF SIMULATION OF PLUVIOGRAPH RECORDS,
Lautrich and Pecher, Dusseldorf (Germany, F.R.).
For primary bibliographic entry see Field 2E.
W85-01698

REAL-TIME ESTIMATION AND FORECASTING OF SPATIALLY DISTRIBUTED AREAL RAINFALL,
Hanover Univ. (Germany, F.R.). Inst. fuer Wasserwirtschaft, Hydrologie und Landwirtschaftlichen Wasserbau.
W. Schilling.
Water Science and Technology, Vol. 16, No. 8/9, p 327-348, 1984. 9 Fig, 5 Tab, 30 Ref.

Descriptors: *Rainfall distribution, *Forecasting, *West Germany, *Areal rainfall, Point rainfall, Kalman filter model, Thiessen procedure, Radar, Weather forecasting, Model studies.

A simple multivariate autoregressive model was developed that quantitatively and automatically forecasts spatially distributed point rainfall for short lead times. For calibration and testing of the point model, data of the 'Emschergenossenschaft' in the Ruhr District, West Germany, were used. The data was assumed to be remotely transmitted; only remotely-transmitted standard raingage data is necessary for model operation. A reliable estimation procedure for areal rainfall should take into account the actual uncertainty of taking the point rainfall as areal rainfall for each specific raingage/subarea. The point model was expanded to forecast and also estimate areal rainfall from point measurements using the Kalman filter technique and the theory of regionalized variables. X-Band-Radar data from the Swist catchment near Bonn was used for verification of the areal rainfall model. In each of 20 measurement periods the Kalman filter estimates outperformed the standard measurements. The Kalman filter model is superior for areal rainfall estimation (compared to the Thiessen procedure) as well as for areal rainfall forecasting compared to trivial forecasts and the point forecasting model mentioned above. (Collier-IVI)
W85-01700

POTENTIAL URBAN RAINFALL PREDICTION MEASUREMENT SYSTEM,
Illinois State Water Survey Div., Champaign.
J. L. Vogel.
Water Science and Technology, Vol. 16, No. 8/9, p 349-362, 1984. 1 Fig, 1 Tab, 33 Ref. NSF grant PFR78-05693.

Descriptors: *Urban rainfall, *Weather forecasting, *Rainfall distribution, *Chicago, *Illinois, Radar, Computers, Rainstorms, Storms, Rain gages, Management planning.

Present raingage systems in many metropolitan regions are capable of monitoring the amount of rain that falls, but unless the raingage network is very dense, extends prohibitively far from the city, and is connected with a computer system to analyze the storm movement, the raingages are not capable of predicting future precipitation patterns and amounts. Continued growth of urban regions and more stringent water quality regulations have resulted in an increased need for more real-time information about past, present, and future patterns and intensities of precipitation. A new prediction/monitoring system for more efficient management of the complex Chicago storm-sewer operational needs consists of five major elements: a 10-cm weather radar incorporating a signal processor; a mini-computer system to analyze the echo data, provide rainfall amounts over the city, and forecast rain which was to occur over the city; telemetered rainfall data from the existing recording raingages of the Sanitary District; meteorologists and standard routine weather facilities; and a communication system connecting the radar and raingages to water control headquarters. The adjunct computer system translates the digital radar data into the rainfall estimates by integrating the raingage-indicated rainfall with the radar signal. It also calculates the motion and rain change fields needed to predict urban rainfall. (Collier-IVI)
W85-01701

STOCHASTIC DESCRIPTION OF TEMPORAL DAILY RAINFALL PATTERNS,
Quebec Univ., Chicoutimi. Dept. des Sciences Appliquees.
V.-T.-V. Nguyen.
Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 234-238, June, 1984. 4 Fig, 14 Ref.

Descriptors: *Stochastic process, *Model studies, *Rainfall, Montreal Island, Quebec, Temporal distribution, Rainfall amount, Rainfall distribution, Markov chain.

A stochastic approach to characterization of temporal patterns is proposed wherein a rainfall event is defined as an unbroken sequence of consecutive daily rainfalls. A stochastic model is developed to determine the probability distribution of cumulative rainfall amounts at the end of each day within a total rainfall event duration of n days. The model is structured such that the distribution of daily rainfall depths can be approximated by an exponential distribution and the rainfall occurrence process can be described by a first-order stationary Markov chain. An illustrative example was presented, using a 32-year daily rainfall record at Dorval Airport on Montreal Island. The results of this example have demonstrated the adequacy and descriptive capabilities of the model. It can be concluded that the methodology proposed seems to be more general and more flexible than those that have been used in previous investigations. (Author's abstract)
W85-01712

CASE STUDY OF HEAVY RAIN SPELL ON 13TH-25TH DECEMBER 1982 OVER THE EAST COAST OF PENINSULAR MALAYSIA AND SINGAPORE,
Singapore Meteorological Service.
C. Tik.
Journal of the Meteorological Society of Japan, Vol. 62, No.2, p 296-307, April, 1984. 9 Fig, 8 Ref.

Descriptors: *Peninsular Malaysia, *Malaysia, *Singapore, *Rainfall, Hadley cell, Wind, Monsoons, Convergence, Air circulation.

The continuous heavy rain spells over the east coast of Peninsular Malaysia and Singapore are frequently associated with the onset phase (November-December) of the northeast winter monsoon, but the mechanism of the heavy rain spells is not well understood. The Hadley cell over the east coast of Peninsular Malaysia and Singapore was studied by means of meridional wind components and vertical p-velocities for the period of the heavy rain spells from 13th to 25th December 1982. The formation of the heavy rain spells over the east coast of Peninsular Malaysia and Singapore are mainly caused by strong upward motions of moist air in the southern branch of the Hadley cell. Some cases may also be explained by the maximum upward velocities in the mid-troposphere due to the upward branch of the Hadley cell circulation. The maximum upward velocities in mid-troposphere are caused by the combination of strong low-level convergence and the initial appearance of the equatorial cell in the southern branch of the Hadley cell. (Moore-IVI)
W85-02125

AGRICULTURAL DROUGHTS AT PEDDAPURAM, EAST GODAVARI DISTRICT, ANDHRA PRADESH,
Andhra Univ., Waltair (India). Dept. of Meteorology and Oceanography.
For primary bibliographic entry see Field 2I.
W85-02126

2C. Snow, Ice, and Frost

ICE COVER MELTING IN A SHALLOW RIVER,
Cold Regions Research and Engineering Lab., Hanover, NH.
D. J. Calkins.
Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 255-265, June, 1984. 11 Fig, 4 Tab, 9 Ref.

Descriptors: *Ice cover, *Melting, *Heat transfer, Water temperature, Diurnal variation, Solar radiation, Frazil ice, River flow, Velocity, Water depth, Air temperature.

The heat transfer coefficients computed from field data on both ice cover melting and water temperature attenuation are higher than the values one would compute based on extrapolation of previous laboratory flume data. The computed heat transfer coefficients were relatively consistent when calculated from the water temperature decay data. Consistent results were also obtained with one set of very detailed ice cover melting data. The diurnal fluctuation in water temperature from the freezing point to values of 0.4-0.6 degrees C was associated with the incoming solar radiation and the open water surface area. The measured water temperature distribution beneath the ice cover at a particular cross section varied from 0.2 to 0.6 degrees C due to the influence of frazil ice and flow distribution. In the open water reaches the water temperature was essentially fully mixed vertically but lateral variation across the river ranged from 0.1 to 0.3 degrees C. The average daily melting of the ice cover often exceeded 5.0 cm and at some locations the rate was as high as 8 cm/d. The melt was not uniform across the section but was highly dependent upon the flow conditions, velocity, and depth. The ice cover melting for this year only occurred during the daylight hours as the air temperatures dropped below 0 degrees C at night and the water temperature likewise decayed to its freezing point. (Author's abstract)
W85-01713

CALCULATION OF MELT-WATER DISCHARGE FROM THE SNOW COVER IN CATCHMENT AREAS IN THE MITTELGEBIRGE MOUNTAINS (BERECHNUNG DER SCHMELZWASSERABGABE AUS DER SCHNEEDECKE IN EINZUGSGEBIETEN DES MITTELGEBIRGES),
Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie.
G. Flemming, and J. Gurtz.
Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 64-66, February, 1983. 4 Fig, 10 Ref.

Descriptors: *Snowmelt, *Mittelgebirge Mountains, *East Germany, *Computer models, Temperature, Snow cover, Precipitation, Catchment area, Mountains, Evaporation.

Computer models for calculating snow melt-water discharge were used to predict discharge patterns in two catchment areas (the Schwarzwasser to the Aue gauge and the Lippersdorfer Bach) in the Mittelgebirge, a mountain range in the German Democratic Republic. The models are based on the daily degree procedure, in which the major factor is temperature, with minor factors of precipitation and snow-cover data. They consist of a frame section and a core section: the former controls program organization and the division of the catchment area into an optional number of levels based upon height above sea-level, which may then be subdivided into bare and forested surfaces; the latter describes snow-cover accumulation, snow melt, and melt-water retention. The SMELT 4 model offers the capability of including not only the mean temperature for each time interval but also the duration of positive (i.e., causing melting) temperatures. Melt intensity, expressed by the so-called degree factor, depends on the amount of water in the snow cover at the beginning of the calculation. SMELT 5 is a physically expanded version of SMELT 4; the melt component is series-connected to components for evaporation and time-dependent accumulation of the snow cover. The models provide a useful base for studying the discharge process in winter and for calculating river flow in general using catchment-area models. (Gish-IVI)
W85-01972

2D. Evaporation and Transpiration

WATER-USE PRODUCTION FUNCTIONS OF SELECTED AGRONOMIC CROPS IN NORTHWESTERN NEW MEXICO, PHASE II,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W85-01817

2E. Streamflow and Runoff

CRITICAL DEPTHS FOR PASSAGE IN BRAIDED RIVERS, CANTERBURY, NEW ZEALAND,
Ministry of Works and Development, Christchurch (New Zealand).
M. P. Mosley.
New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 3/4, p 351-357, 1982. 7 Fig, 4 Ref.

Descriptors: *Canterbury, *New Zealand, *Ashley River, *Hurunui River, *Braided streams, *Rakaia River, Water depth, Stream flow, Minimum flow.

Riffles and points of divergence of branch channels in braided rivers are critical controls upon passage of fish and recreational boats because they are points at which depths are at a minimum. Depths on randomly selected riffles were measured in braided reaches of the Ashley, Hurunui, and Rakaia Rivers and related to discharge; minimum depths encountered in extended reaches of these rivers at a range of flows have also been measured. The data can be used to predict minimum available passage depths at a specified flow, or conversely, to predict the discharge required to maintain a specified minimum passage depth. However, presently available estimates of critical minimum depths required for various instream uses (migration of salmonids, jetboating) appear excessively conservative, and minimum depth requirements must be more accurately determined before instream flow needs can be properly assessed. (Author's abstract)
W85-01636

FLOOD-PLAIN MANAGEMENT PROGRAM IN RAPID CITY, SOUTH DAKOTA,
South Dakota School of Mines and Technology, Rapid City. Dept. of Geology and Geological Engineering.
P. H. Rahn.
Geological Society of America Bulletin, Vol. 95, No. 7, p 838-843, July, 1984. 7 Fig, 16 Ref.

Descriptors: *Rapid City, *South Dakota, *Flood plain management, Floodways, Flood plains, Flood damage.

Following the devastating flood of June 9, 1972, Rapid City, South Dakota, embarked on a flood-plain management program. A 'floodway' was delinated and all homes and motels, as well as most commercial establishments, were removed from the floodway. Almost the entire area inundated by the 1972 flood is now a beautiful park, illustrating that man can live in harmony with natural processes without spending vast sums of money for hard engineering structures such as dams or levees. From a national perspective, it is desirable to reserve flood plains for agricultural use. Unfortunately, many flood plains are being urbanized, which not only take agricultural land out of production, but also gives impetus to dam construction that results in the inundation of more land. (Author's abstract)
W85-01643

REVIEW OF RAINFALL DATA APPLICATION FOR DESIGN AND ANALYSIS,
VIAK Consultants, Linkoeping (Sweden).
For primary bibliographic entry see Field 2B.
W85-01677

DESIGN STORM FOR A TROPICAL LOCATION WITH LIMITED DATA,
Hydraulics Research Station, Wallingford (England).
For primary bibliographic entry see Field 2B.
W85-01678

SYNTHETIC DESIGN STORM AND ITS RELATION TO INTENSITY-DURATION FREQUENCY CURVES,
Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia). Dept. of Sanitary Engineering.
For primary bibliographic entry see Field 2B.
W85-01679

STATISTICAL METHODS OF STORM ANALYSIS,
Agricultural Research Service, Beltsville, MD. Hydrology Lab.
For primary bibliographic entry see Field 2B.
W85-01680

RAINFALL AS THE BASIS FOR URBAN RUNOFF - EXPERIENCE AND PRACTICE IN YUGOSLAVIA,
Split Univ. (Yugoslavia). Faculty of Engineering.
For primary bibliographic entry see Field 2B.
W85-01682

DEPTH-DURATION MODELS OF SHORT TIME INCREMENT RAINFALL,
Purdue Univ., Lafayette, IN. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2B.
W85-01683

RAINFALL EVENTS AS PATHS OF A STOCHASTIC PROCESS: PROBLEMS OF DESIGN STORM ANALYSIS,

Technische Univ., Munich (Germany, F.R.). Lehrstuhl und Pruefamt fuer Wassergutewirtschaft und Gesundheitsingenieurwesen.
For primary bibliographic entry see Field 2B.
W85-01684

TIME PATTERNS OF RAINFALL FOR ESTIMATING DESIGN FLOODS ON A FREQUENCY BASIS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 2B.
W85-01687

TEMPORAL DISTRIBUTION OF DESIGN STORM RAINFALL,
National Water Research Inst., Burlington (Ontario).
For primary bibliographic entry see Field 2B.
W85-01688

EFFECT OF SPATIAL RAINFALL DISTRIBUTION ON SEWER FLOWS,
Hanover Univ. (Germany, F.R.). Inst. fuer Wasserwirtschaft, Hydrologie und Landwirtschaftlichen Wasserbau.
W. Schilling.
Water Science and Technology, Vol. 16, No. 8/9, p 177-188, 1984. 10 Fig, 8 Ref.

Descriptors: *Rainfall distribution, *Sewer hydraulics, *Rainfall-runoff relationships, Urban hydrology, Runoff forecasting, Runoff rates, Artificial storms.

When using a runoff model to generate input data for statistical computations, e.g. water balance, urbanization effects, design of dams, etc., the input data and the runoff model should produce flow features which are correct on the average; the computed probability density function of peak, volume, and time-to-peak should not differ radically from the true ones. Errors in computing flows are caused by uncertainties about input data as well as uncertainties about appropriate models and model parameters. Errors of the input 'rainfall', especially errors in spatial resolution, propagate by computation of sewer flows. Results of a case study about a sewer system with a catchment area of 2 sq km and ca. 1000 reaches between manholes show - that mean errors in rainfall event depths of about 20% occur even with five raingages within or close to the catchment - that the errors by disregarding the spatial distribution are amplified rather than damped by the rainfall-runoff transformation and - that using spatially homogeneous rainfall input for flow computations cause systemic errors due to the wrong assumption of spatially homogeneous initial losses and due to dominating directions of storm movement. When using artificial storms, the spatial and temporal rainfall variability should be taken into account. (Collier-IVI)
W85-01689

AREAL REDUCTION FACTORS ON SHORT TIME AND SPACE INTERVALS,
Montpellier-2 Univ. (France). Lab. d'Hydrologie Mathematique.
For primary bibliographic entry see Field 2B.
W85-01690

DESIGN INFLOW INTENSITY AND DESIGN INFLOW PROFILES FOR STORM SEWERS,
Rijksdienst voor de Ijsselmeerpolders, Lelystad (Netherlands).
F. H. M. van de Ven.
Water Science and Technology, Vol. 16, No. 8/9, p 207-218, 1984. 5 Fig, 5 Tab, 7 Ref.

Descriptors: *Storm sewers, *Design inflow intensity, *Design inflow profiles, *Netherlands, *Lelystad, *Sewer hydraulics, Sewers, Rainfall distribution, Discharge frequency, Depth-duration-frequency curves.

Twelve year records of rainfall and of sewer inflow data in a housing area and in a parking lot in Lelystad, The Netherlands, were available. These data series contained 5-minute depths of rainfall and sewer inflow. Depth-duration-frequency curves were calculated from the monthly extremes, using Box-Cox transformation and a Gumbel distribution. The differences between the curves for rainfall and for inflow are explained by inertia and rainfall losses. These differences are the reason to use inflow as a sewer design parameter. For the choice of the design discharge (or inflow) intensity the curves are not well suited. Storage-design, discharge-frequency curves proved to be better interpretable. The selected design discharge is 4 or 5 cu m/s/sq km. For non-steady flow calculations in sewer systems an inflow profile has to be provided. The profile should be peaked. The most common location of the peak lies between 20 and 50% of the event duration. The return period of the profile has to be known. A bivariate extreme value distribution is used to estimate this return period. From these distributions synthetic inflow profiles could be calculated. (Author's abstract)
W85-01692

EVALUATION OF URBAN DESIGN STORM SENSITIVITY,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2B.
W85-01693

STAGED APPROACH TO APPLICATION OF RAINFALL DATA TO URBAN RUNOFF CALCULATIONS,
Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.
P. Harremoes, M. Jensen, and N. B. Johansen.
Water Science and Technology, Vol. 16, No. 8/9, p 237-250, 1984. 6 Fig, 15 Ref.

Descriptors: *Urban runoff, *Urban hydrology, *Rainfall distribution, *Denmark, Intensity-duration-frequency curves, Model studies, Mathematical studies, Computer programs.

A coherent staged approach to application of rain data from long rain records to urban storm drainage has been developed in Denmark and is in the process of being implemented at the central computer center of the Danish municipalities. The approach is based on the principal that a spectrum of methods should be made available to the practitioner, from the simplest calculation by hand to the most advanced application of historical rain events as input to the most complicated computer programs. The simplest method is the traditional use of intensity-duration-frequency curves and the rational method. This is equivalent to running a time-area method with a straight time-area curve through all the rain events of a historical rain series. The form factor is used to multiply the flow obtained from the rational method. The use of the rational method with a form factor between 1.0-1.4 is recommended, depending on an estimated shape of the time-area curve. From that basis there are stages of increasing sophistication; the utopian approach is to run all recorded rain events of a rain series through the best available computer programs with very accurate data for the catchment under consideration. The best available programs involve a continuous hydrological simulation model and a model based on the dynamic wave theory for pipe flow. The choice of method depends on the level of ambition and the accuracy of the basic input data for the catchment in question. (Collier-IVI)
W85-01694

RAINFALL DATA FOR THE DESIGN OF DETENTION BASINS,
VIAK Consultants, Linkoeping (Sweden).
V. Arnell.
Water Science and Technology, Vol. 16, No. 8/9, p 255-270, 1984. 7 Fig, 6 Tab, 13 Ref.

Descriptors: *Detention reservoirs, *Urban runoff, *Storm runoff, *Storm water, *Rainfall distribution, *Hydraulic design, Design storms, Storms, Mathematical analysis, Model studies, Rainfall-runoff relationships.

This paper describes the selection of rainfall data for design of detention basins. The use of design storms (the uniform intensity design storm, the Chicago design storm and the Sifalda design storm) was compared with the use of historical storms where the historical storms were assumed to give the most correct result. Historical storms were selected from an 18-year rainfall record; local coefficients were estimated from the same record. Three test catchments were used and detention basins were located at the outlet of each basin. For the runoff simulations, the CTH-Urban Runoff Model was used which also included a detention basin submodel. The results show the importance of design storms having total volumes that correspond to the volumes of historical storms. Use of the uniform intensity design storm and the Chicago design storm resulted in underestimated detention basin volumes. The Sifalda design storm caused overestimated basin volumes which can be reduced after an improvement of the storm. (Author's abstract)
W85-01695

INFLUENCE OF RAINFALL CHARACTERISTICS ON THE POLLUTION EMISSION,
DHV Consulting Engineers, Amersfoort (Netherlands).
K. Bakker, and H. S. J. van Wieringen.
Water Science and Technology, Vol. 16, No. 8/9, p 285-295, 1984. 3 Fig, 3 Tab, 6 Ref.

Descriptors: *Water pollution sources, *Storm wastewater, *Rainfall impact, *Combined sewers, Combined sewer overflows, Storm runoff, Sewers, Storage reservoirs, Runoff coefficient, Overflow, Urban hydrology, Urban runoff, Biological oxygen demand, Chemical oxygen demand, Suspended solids.

An extensive data collection program has been implemented in the Netherlands which provides data on quantities and qualities of stormwater discharges from sewer systems into surface water. To protect the quality of surface waters the combined sewer system is designed to act as a storage reservoir; overflows are restricted by enlarging the storage capacity of individual sewers which is accomplished by overdimensioning of individual sewers. Virtually all sewers in the Netherlands are situated below the level of the overflow weir. Each catchment studied is equipped with continuously recording rain and water level gauges. The measurements started in 1981 at the combined sewer system of Loenen and were later started at other locations. Run-off coefficients were derived from water balances for various storms and show a distinct seasonal influence. In winter time, the coefficients related to impervious area appear to be higher than 1.0. During summer, coefficients considerably below 1.0 have been found. The emission of suspended solids appears to depend on rainfall characteristics. The time of filling of the sewer system reflects these characteristics and appears to be decisive for the concentrations of the suspended solids at the beginning of an overflow. The same holds true for BOD and COD. Long filling times result in much lower concentrations as compared to short filling times. Suspended solids concentrations during an overflow could be predicted by taking into account the washout of the pollutants and the discharge at the overflow weir. (Collier-IVI)
W85-01697

OVERFLOW DATA OF RAINWATER DISCHARGE SYSTEMS DETERMINED FROM RUN OFF SIMULATION OF PLUVIOGRAPH RECORDS,
Lautrich and Pecher, Dusseldorf (Germany, F.R.).
R. Pecher.
Water Science and Technology, Vol. 16, No. 8/9, p 297-309, 1984. 9 Fig, 4 Tab, 8 Ref.

Descriptors: *Urban runoff, *Rainfall-runoff relationships, *Overflow, *Pluviographs, *Runoff simulation, Simulation, Sewer systems, Combined sewers, Statistical analysis.

In the last years, the relieving activity of overflow structures in combined sewer systems was mainly determined by statistical analysis of rainfall data. Due to the rain lost on the surface of a drainage area and to the flow retardation through the sewer network, the resulting runoff variation differs a lot from the rainfall variation. Therefore, the rainfall measurements of 4 rain gaging stations in Hamburg with a total of 67 recorded years and a rain gaging station in Berlin with 22 recorded years were used to carry out runoff simulations. A rainfall statistical analysis was performed with the measured rainfall data in order to determine the annual rainfall durations, depths and frequencies in relation to the average rain intensity. The annual overflow data from overflow structures (overflow weirs and overflow basins) of nonprerelieved drainage areas were computed by means of a simplified runoff model. The so determined overflow data was considerably lower than the data of rainfall analysis. Overflow data from overflow structures in combined sewer systems would not be satisfying if they are derived from only statistical rainfall analysis. Recorded rainfall events should rather be transformed into runoff events and accordingly analyzed. As there were only 5 rain gaging stations available, a generalization of the computed overflow data is still impossible. However, these overflow data seem to be plausible on the whole if compared with rainfall data which were collected in the past only during the summer months. (Author's abstract)
W85-01698

METHODS FOR CALCULATION OF ANNUAL AND EXTREME OVERFLOW EVENTS FROM COMBINED SEWER SYSTEMS,
Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.
N. B. Johansen, P. Harremoes, and M. Jensen.
Water Science and Technology, Vol. 16, No. 8/9, p 311-325, 1984. 9 Fig, 4 Tab, 14 Ref.

Descriptors: *Urban runoff, *Overflow, *Combined sewer systems, *Rainfall-runoff relationships, Water pollution sources, Statistical analysis, Urban hydrology.

Overflow from combined systems constitute an increasing source of pollution of receiving waters, as compared to daily wastewater discharges which undergo treatment to a still higher extent. The receiving water problems from overflows are significant both in a long term scale (mean annual load) and in a short term scale (extreme event load). A method for computation of both annual and extreme load was developed based on historical rain series and the use of a time-area model and simple pollutant mixing model in runoff calculation. Statistical calculations for both mean annual load and extreme events have been applied to the computed overflow series. Based on the computerized method simple manual calculation methods have been developed, resulting in graphs and tables for annual load and extreme load. (Author's abstract)
W85-01699

RECONNAISSANCE OF SURFACE WATER RESOURCES IN THE TOGIAK RIVER BASIN, SOUTHWESTERN ALASKA, 1980 AND 1982,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 2A.
W85-01777

STREAMFLOW CHARACTERISTICS OF THE YELLOWSTONE RIVER BASIN, MONTANA, THROUGH SEPTEMBER 1982,
Geological Survey, Helena, MT. Water Resources Div.
R. J. Omang.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 84-4063, 1984. 78 p, 1 Fig, 71 Tab, 6 Ref.

Descriptors: *Low flow, *Flood frequency, *Flow duration, Gaging stations, Streams discharge, Yellowstone River basin, *Montana.

Statistical summaries of streamflow data for selected stream-gaging sites are presented in this report to aid in appraising streamflow in the Yellowstone River basin. Streamflow records are presented for 71 gaging stations for the period of record. Streamflow record collection in the Yellowstone River basin began in 1889. For each gaging station selected for this report, a brief description is given for station location, drainage area, period of record, revisions of previously published records, type and history of gages, regulation and diversions, average discharge, and extremes of discharge. This information is followed by tables of monthly and annual flow statistics, flood-frequency data, low-flow and high-flow frequency data, and flow-duration data. (USGS)
W85-01781

HYDROLOGIC RESPONSES OF STREAM'S TO MINING OF THE MULBERRY COAL RESERVES IN EASTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
H. E. Bevans.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 84-4047, 1984. 30 p, 12 Fig, 6 Tab, 13 Ref.

Descriptors: *Water quality, *Streamflow, *Coal mining, Dissolved solids, Sulfate, Suspended sediment, Flow duration, Storm runoff, Detention reservoirs, *Coal hydrology, *Kansas, Marais des Cygnes River, Little Osage River, Linn County, Miami County, Bourbon County, Mulberry Coal.

The U.S. Geological Survey investigated the hydrologic responses of streams with respect to coal-mining activities in the Mulberry coal reserves of Miami, Linn, and Bourbon Counties, eastern Kansas. Results of a low-flow water-quality reconnaissance showed that small streams draining previously coal-mined areas generally have relatively large concentrations of sulfate. Large streams in the study area have been relatively unaffected by coal mining. A comparison of two small drainage basins showed that the basin affected by an active strip mine had less high flow and more low flow because of the regulating effects of sediment ponds. Effluent pumped from the strip mine increased the load of sulfate by 244 percent, the load of dissolved solids by 41 percent, and occasionally transported relatively large concentrations of iron, lead, manganese, and zinc to the receiving stream. Accelerated erosion caused by the exposure and disturbance of soil during clearing and excavation increased the sediment load of the receiving stream by 25 percent even though sediment ponds were installed. (USGS)
W85-01782

EFFECTS OF THE DROUGHT OF 1980-81 ON STREAMFLOW AND ON GROUND-WATER LEVELS IN GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
R. F. Carter.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4158, 1983. 46 p, 23 Fig, 3 Tab, 8 Ref.

Descriptors: *Low flow, *Flow frequency, *Ground-water levels, Reservoir stages, *Streamflow, *Groundwater, Water resources, *Georgia.

The 1980-81 drought resulted in the lowest rates of streamflow since 1954 in most areas of Georgia, and the lowest since 1925 in some areas. Over most of the State, minimum average streamflows for periods of 1, 7, 30, 60, 90, and 183 consecutive days receded to low levels estimated to be reached at average intervals of 10 to 25 years. Flows in the Flint River from central to southwest Georgia receded to levels estimated to be reached at average intervals of 70 years. Pool levels at four major reservoirs receded to the lowest levels since the reservoirs were first filled. Ground-water levels declined below the lowest levels previously observed in many observation wells. Nearly continuous declines were recorded in some wells for as much as 20 consecutive months, and levels remained below the previous minimum level of record for as much as 9 consecutive months. (USGS)
W85-01783

PREDICTION OF PEAK FLOWS FOR CULVERT DESIGN ON SMALL WATERSHEDS IN OREGON,
Oregon State Univ., Corvallis. School of Forestry.
For primary bibliographic entry see Field 4A.
W85-01820

DAILY WATER AND SEDIMENT DISCHARGES FROM SELECTED RIVERS OF THE EASTERN UNITED STATES: A TIME-SERIES MODELING APPROACH,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2J.
W85-01823

WATER RESOURCES DATA, KENTUCKY, WATER YEAR 1982,
Geological Survey, Louisville, KY. Water Resources Div.
J. M. Bettandorff, J. N. Sullavan, D. W. Leist, and D. V. Whitesides.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-162320. USGS Water-Data Report KY-82-1, (May, 1983). 517 p. Prepared in cooperation with the state of Kentucky and with other agencies.

Descriptors: *Kentucky, *Hydrologic data, *Surface waters, *Water quality, *Groundwater, Gaging stations, Streamflow, Flow rates, Lakes, Wells, Chemical analyses, Suspended sediments, Water temperature, Water levels, *Data collections.

Water resources data for the 1982 water year for Kentucky consist of records of stage, discharge, and water quality of streams; stage and contents of lakes; and water levels and water quality of wells and springs. This report contains discharge records from 115 gaging stations; stage and contents for 15 lakes; suspended-sediment data for 38 stations (12 daily); daily temperature records for 26 stations; daily specific conductance for 14 stations; groundwater level for 75 recording; 99-partial sites; water-quality data from 24 stations sampled at regular intervals and 70 wells; and miscellaneous temperature and specific conductance from the 115 gaging stations. Also included are data for 118 partial-record crest-stage sites. Data collected at various miscellaneous sites is also published. (USGS)
W85-01923

ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO, 1982,
Geological Survey, Albuquerque, NM. Water Resources Div.
R. R. Cruz.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 83-695, 1983. 32 p, 13 Fig, 7 Tab, 5 Ref.

Descriptors: *Hydrologic data, *Groundwater, Potentiometric level, *Water quality, *Slope-area measurement, Peak flow, *New Mexico, Military installation, White Sands Missile Range.

Ground-water data were collected in 1982 at White Sands Missile Range in south-central New Mexico. Depth-to-water measurements in the Post Headquarters supply wells continued to show seasonal declines. Test wells east of the Headquarters well field continue to show long-term declines as well as seasonal fluctuations. The total amount of water pumped from White Sands Missile Range supply wells was 66,226,600 gallons more in 1982 than in 1981. The difference in the specific-conductance values of the water samples collected from the Post Headquarters supply wells in the winter and summer increased in 1982. (USGS)
W85-01927

WATER RESOURCES DATA, IOWA, WATER YEAR 1982,
Geological Survey, Iowa City, IA. Water Resources Div.
I. L. Burmeister, V. L. Spiers, P. J. Soenksen, and W. J. Matthes, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-137215. USGS Water-Data Report IA-82-1, 1983. 262 p, 10 Fig, 2 Tab. Prepared in cooperation with the State of Iowa and other agencies.

Descriptors: *Iowa, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rates, Streamflow, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperature, Sampling sites, Water levels, Water analyses, *Data collections, Water wells.

Water resources data for the 1982 water year for Iowa consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 116 gaging stations; stage contents for 7 lakes and reservoirs; water quality for 17 gaging stations; and water levels for 34 observations wells. Also included are 125 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. (USGS)
W85-01931

WATER RESOURCES DATA, KANSAS WATER YEAR 1982,
Geological Survey, Lawrence, KS. Water Resources Div.
C. O. Geiger, D. L. Lacock, L. R. Shelton, M. L. Penny, and C. E. Merry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-84128396. USGS Water-Data Report KS-82-1, 1983. 485 p, 8 Fig, 6 Tab. Prepared in cooperation with the State of Kansas and with other agencies.

Descriptors: *Kansas, Hydrologic data, Surface water, Groundwater, Water quality, Flow rates, Gaging stations, Lakes, Reservoirs, Chemical analysis, Sediments, Water temperature, Water level, Water analysis, *Data collections, Sampling sites.

Water resources data for the 1982 water year for Kansas consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and miscellaneous water quality in wells. This report contains discharge records for 145 gaging stations; stage and contents for 24 lakes and reservoirs; water quality for 58 gaging stations; and water levels for 475 observation wells and miscellaneous water quality for 96 wells. Also included are data for 91 crest-stage partial-record stations. (USGS)
W85-01932

WATER RESOURCES DATA, NEW HAMPSHIRE AND VERMONT, WATER YEAR 1982,
Geological Survey, Boston, MA. Water Resources Div.
F. E. Blackey, J. E. Cotton, and K. W. Toppin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-161868. USGS Water-Data Report NH-VT-82-1, 1983. 145 p, 3 Fig. Prepared in cooperation with the States of New Hampshire and Vermont and with other agencies.

Descriptors: *New Hampshire, *Vermont, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1982 water year for New Hampshire and Vermont consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and ground-water levels. This report contains discharge records for 73 gaging stations, stage records for 4 lakes, month end contents for 25 lakes and reservoirs, water-quality data for 4 gaging stations, and water levels for 30 observation wells. Also included are data for 3 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. Locations of gaging stations, partial-record stations, and observation wells are shown in figure 1. A few pertinent stations (not included above) in bordering States and Province of Quebec are also included in this report. (USGS)
W85-01933

WATER RESOURCES DATA, ARKANSAS, WATER YEAR 1982,
Geological Survey, Little Rock, AR. Water Resources Div.
T. E. Lamb, J. E. Porter, B. F. Lambert, and J. Edds.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-181296. USGS Water-Data Report AR-82-1, 1983. 503 p, 5 Fig, 3 Tab. Prepared in cooperation with the State of Arkansas and with other agencies.

Descriptors: *Arkansas, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water resources data for the 1982 water year for Arkansas consist of records of gage height, discharge, and water quality of streams; elevation, contents, and water quality of lakes; water levels and water quality of observation wells. This report contains discharge records for 55 gaging stations; water quality for 149 stations, 47 partial-record stations, 25 observation wells; and water levels for 95 observation wells. Also included are data for 99 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. (USGS)
W85-01934

WATER RESOURCES DATA, MASSACHUSETTS AND RHODE ISLAND, WATER YEAR 1982,
Geological Survey, Boston, MA. Water Resources Div.
R. A. Gadoury, G. G. Girouard, and D. F. Letty.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-180009. USGS Water-Data Report MA-RI-82-1, 1984. 237 p, 5 Fig, 1 Tab. Prepared in cooperation with the States of Massachusetts and Rhode Island and with other agencies.

Descriptors: *Massachusetts, *Rhode Island, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1982 water year for Massachusetts and Rhode Island consist of records of stage, discharge, and water quality of streams; contents of lakes and reservoirs; and ground-water levels. This report contains discharge records for 97 gaging stations, month end contents for 30 lakes and reservoirs, water quality for 10 gaging stations, and water levels for 107 observation wells. Also included are data for 3 low-flow and 18 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. A few pertinent stations (not included above) in bordering States are also included in this report. (USGS)
W85-01935

WATER RESOURCES DATA, NORTH DAKOTA, WATER YEAR 1982,
Geological Survey, Bismarck, ND. Water Resources Div.
R. E. Harkness, and N. D. Haffield.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-136589. USGS Water-Data Report ND-82-1, 1983. 418 p, 18 Fig, 2 Tab. Prepared in cooperation with the State of North Dakota and with other agencies.

Descriptors: *North Dakota, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water resources data for the 1982 water year for North Dakota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report contains discharge records for 110 gaging stations; stage only records for 21 gaging stations; stage and contents for 12 lakes and reservoirs; water quality for 114 gaging stations; 8 lakes, 67 wells, and water levels for 31 observation wells. Additional water data were collected at various sites, not involved in the systematic data collection program, and are published as miscellaneous measurements. (USGS)
W85-01936

WATER RESOURCES DATA, SOUTH CAROLINA, WATER YEAR 1982,
Geological Survey, Columbia, SC. Water Resources Div.
C. S. Bennett, R. D. Hayes, J. W. Gissendanner, and H. E. Herlong.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-84162577. USGS Water-Data Report SC-82-1, 1983. 330 p, 5 Fig. Prepared in cooperation with the State of South Carolina and with other agencies.

Descriptors: *South Carolina, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water resources data for the 1982 water year for South Carolina consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 78 gaging stations, stage only at 5 gaging stations, stage and contents at 11 lakes and reservoirs, water quality at 37 gaging stations, and water levels at 57 observation wells. Also included are data for 42 crest-stage partial-record stations. Locations of these sites are shown on figures 3, 4, and 5. Additional water data were collected at various sites not involved in the systematic data-collection program. (USGS)
W85-01937

WATER RESOURCES DATA, GEORGIA, WATER YEAR 1982,
Geological Survey, Doraville, GA. Water Resources Div.
W. R. Stokes, III, T. W. Hale, J. L. Pearman, and G. R. Buell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-128412. USGS Water-Data Report GA-82-1, 1983. 390 p, 8 Fig, 1 Tab. Prepared in cooperation with the State of Georgia and with other Federal agencies.

Descriptors: *Georgia, *Hydrologic data, *Surface water, *Water quality, *Groundwater, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Wells, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water resources data for the 1982 water year for Georgia consists of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and ground-water levels. This report contains discharge records of 109 gaging stations; stage for 10 gaging stations; stage and contents for 17 lakes and reservoirs; water quality for 17 continuous stations, 115 periodic stations

and miscellaneous sites; peak stage and discharge only for 109 crest-stage partial-record stations and 20 miscellaneous sites; measurements of discharge at 49 low-flow partial-record stations and 15 miscellaneous sites; and water levels of 28 observation wells. (USGS)
W85-01938

WATER RESOURCES DATA, ALABAMA, WATER YEAR 1982,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
H. C. Rollins, F. C. Sedberry, E. G. Ming, and I. A. Giles.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-183250. USGS Water-Data Report AL-82-1, 1983. 467 p, 7 Fig, 1 Tab. Prepared in cooperation with the Geological Survey of Alabama, the Alabama Highway Department, and with other State, Municipal, and Federal agencies.

Descriptors: *Alabama, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water resources for the 1982 water year for Alabama consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels in wells. This report contains discharge records for 85 gaging stations; stage only for 16 gaging stations, stage and contents for 12 lakes and reservoirs; water quality for 67 gaging stations and 76 wells, and water levels for 52 observation wells. Also included are 10 crest-stage partial-record stations, 8 flood hydrograph partial-record stations and 91 water-quality partial record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. (USGS)
W85-01939

FLOOD-FREQUENCY ESTIMATES FOR FIVE GAGED BASINS IN WICHITA, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2A.
W85-01949

INTEGRATED METHODOLOGY FOR IN-STREAM FLOW STRATEGIES,
Duke Univ., Durham, NC. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W85-01951

FORECASTING OF WATER LEVEL AND DISCHARGE OF THE ELBE WITH THE AID OF FUZZY MODELLING (VORHERSAGE VON WASSERSTAND UND DURCHFLUSS FUR DIE ELBE MIT HILFE EINER UNSCHARFEN MODELLIERUNG),
Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie.
N. Hansel, R. Oppermann, and B. Straube.
Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 67-69, February, 1983. 6 Fig, 5 Tab, 8 Ref.

Descriptors: *Flow discharge, *Water level, *Forecasting, *Fuzzy modeling, *Elbe, *East Germany, Model studies, Computers, Hydrologic models.

Fuzzy modelling has proven to be an effective method of forecasting the water level (W) and discharge (Q) of large rivers because it allows a description of the river as a whole, set-up of the model using relatively few data, consideration of new observations, direct utilization of experiences of professionals in the subject field, and inclusion of information gathered after the model has been set in motion. A fuzzy model was used to predict W and Q for the East German portion of the Elbe river together with its main tributaries, Mulde and Saale. Input data were taken from measurements made at three gauges (one on each river) in the 1960s and 70s, and model results were compared with the actual situation. The model consists principally of five fuzzy relationships, R1-5. R1 is a fuzzy classifier representing the relationship between the progress line measured at gauge 1 and a set of hydrologically meaningful patterns. The dynamic situation at gauge 1 is represented by the values X1-3, R2 and R3 are constructed similarly for gauges 2 and 3. R4 classifies the situation at the forecast gauge (X10) at a point in time t1 into 'high' or 'low.' R5 represents the relationship between T1-3, the water-level set H (resulting from R4), and the predicted-value set, Y. The model was found to be highly accurate, and it will be possible to improve it further with practical experience. The model can be expanded at the X1-10 level to include previously measured values or those collected at smaller time intervals. The model is programmed in FORTRAN and was run on an SM4 minicomputer. (Gish-IVI)
W85-01973

FLOOD POTENTIAL OF FORTYMILE WASH AND ITS PRINCIPAL SOUTHWESTERN TRIBUTARIES, NEVADA TEST SITE, SOUTHERN NEVADA,
Geological Survey, Carson City, NV. Water Resources Div.
R. R. Squires, and R. L. Young.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4001. 33 p, 23 Fig, 5 Tab, 12 Ref.

Descriptors: *Flood frequency, *Regional floods, Flood channels, *Flood discharge, Flood plains, Flood recurrence interval, Roughness coefficient, Regression analysis, Fortymile Wash, *Nevada, *Nevada Test Site, 100-year flood, 500-year flood, Busted Butte Wash, Drill Hole Wash, Yucca Wash.

Analysis of flood hazards for a 9-mile reach of Fortymile Wash and three of its tributaries was undertaken to aid in determining possible sites for the storage of radioactive wastes. Data from 12 peak-flow gaging stations adjacent to the Test Site were used to develop regression relations that permit an estimation of the magnitude of the 100- and 500-year flood peaks. The regional maximum flood was estimated on the basis of data from extreme floods elsewhere in Nevada and in surrounding states. On Fortymile Wash (drainage area at farthest downstreams cross section, 312 sq mi), the estimated maximum water depth for the three flood magnitudes are 8, 11, and 29 feet, respectively. Mean flow velocities would be as great as 9, 14, and 28 ft/s.
W85-02037

ESTIMATION OF NATURAL STREAMFLOW IN THE JEMEZ RIVER AT THE BOUNDARIES OF INDIAN LANDS, CENTRAL NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
E. E. Fischer, and J. P. Borland.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 82-4113, 1983. 27 p, 3 Fig, 9 Tab, 17 Ref.

Descriptors: Streamflow, Reservoirs, Hydraulic characteristics, Water losses, Streamflow routing, *Indian lands, Surface water, Streamflow records, Trans-basin diversion, Irrigation diversion, Jemez River, *New Mexico, Sandoval County.

Natural streamflow in the Jemez River at the boundaries of Indian lands was estimated from available streamflow records which were adjusted by estimated losses of water due to man-made changes in the hydraulic characteristics of the river basin. The average estimate annual natural streamflow is 53,180 acre-feet at the upstreams boundary of the Jemez Indian Reservation, 53,180 acre-feet at the Jemez--Zia Indian Reservation boundary, 55,440 acre-feet at the Zia--Santa Ana Indian Reservation boundary, and 46,550 acre-feet at the downstream boundary of the Santa Ana Reservation. (USGS)
W85-02048

FLOODS OF AUGUST 7-8, 1979, IN CHAUTAUQUA COUNTY, NEW YORK, WITH HYDRAULIC ANALYSIS OF CANADAWAY CREEK IN THE VILLAGE OF FREDONIA,
Geological Survey, Albany, NY. Water Resources Div.
R. Lumia, and W. H. Johnston.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4211, 1984. 16 p, 8 Fig, 3 Tab, 17 Ref.

Descriptors: *Floods, *Flood profiles, *Flood peak, *Water-surface profiles, Rainfall intensity, Flood-frequency, Indirect flood measurement, *New York, Rainfall frequency, Debris jam, Chautauqua county, Fredonia.

Extensive flooding of streams in Chautauqua County, N.Y., on August 7-8, 1979, after severe thunderstorms, resulted in one death and millions of dollars worth of property damage. Severe flooding was reported on Canadaway Creek in Fredonia, where the peak discharge was computed to be 12,000 cubic feet per second. The recurrence interval of this discharge is estimated to be greater than 100 years (exceedance probability less than 0.01). A hydraulic analysis of the flood in Fredonia indicated that a debris jam at the Water Street bridge caused the water level (as determined from floodmarks) immediately upstream from the bridge to be 2.9 feet higher than level computed for unobstructed (without debris) flow conditions. The 100-year flood discharge at the Water Street bridge is computed to be 5,280 cubic feet per second, and the corresponding water level just upstream from the bridge (under unobstructed flow conditions) is 5.9 feet lower than the level observed during the August 7-8, 1979 flood. (USGS)
W85-02051

COMPUTATION OF CONTINUOUS STREAMFLOW RECORDS,
Geological Survey, Reston, VA. Water Resources Div.
E. J. Kennedy.
Available from the Distr. Br., USGS, 604 S. Pickett St., Alex., VA 22304. USGS Techniques of Water-Resources Investigations (Book 3, Chapter A-13), 1983. 53 p, 34 Fig, 5 Ref.

Descriptors: *Hydrometry, *Stream gages, *Hydrologic data collections, Channel flow, Water measurement, Streamflow.

Records of continuous streamflow, published in the U.S. Geological Survey annual Water Data Reports for the States and territories, are computed from field data, mainly discharge measurements and recorder charts or tapes. This manual describes the computation procedures used and some details of related field operations. It was compiled mostly from unpublished Water Resource Division district manuals edited and supplemented to emphasize digital-recorder and associated computer use. Methods used primarily for graphic-recorder gaging stations and non-recording gages are also included. Reference is made to other publications for some of the more specialized or unusually complex procedures. (USGS)
W85-02053

DIURNAL VARIATION IN THE OXYGEN UPTAKE OF RIVER SEDIMENTS IN VITRO BY USE OF CONTINUOUS FLOW-THROUGH SYSTEMS,
Copenhagen Univ., Hilleroed (Denmark). Det Ferskvands-Biologiske Lab.
E. Jeppesen.
Hydrobiologia, Vol. 91, p 189-195, July, 1982. 4 Fig, 15 Ref. Danish Research Foundation grant 521/28-2.

Descriptors: *Susaa River, *Denmark, *Sediment-water interface, *Oxygen uptake, *Fluvial sedi-

ments, *Measuring instruments, Water temperature, Exchange rate, Aerobic conditions.

Various incubation methods have been used for the measurement of oxygen exchange over the sediment-water surface in lotic environments. In Danish river systems the diurnal variations in oxygen concentration and the temperature in the summer are often quite high (5-21 mg O2/L and 5-8 C) and the sediment is very heterogenous. These conditions must be considered when designing an incubation system. The diurnal exchange of oxygen, over the sediment-water interface, was measured on 'undisturbed' sediment cores incubated on the river bank of three reaches in the river Susaa, Denmark. The incubation chambers were equipped with a double pumping system, driving an internal and an external flow, respectively. The internal flow created a unidirectional flow over the sediment surface, with the same velocity as the natural river flow. River water was pumped through the incubation chambers (external flow) and through a registration chamber equipped with an oxygen probe and a temperature transducer. Various methods were used for the numerical solution of the differential equation which describes the rate of exchange of oxygen. On permanently dark sediment samples, a hysteresis effect between the oxygen exchange rate and the oxygen concentration and temperature appeared. The exchange rates were lower in periods with increasing oxygen concentration. A minimum in the exchange rate was obtained before the minimum in the concentration of oxygen and temperature was found. This type of hysteresis could be explained by equilibration in connection with the transient state conditions. The hysteresis was probably enlarged by shifts in the size of the aerobic layer in the sediment. (Collier-IVI)
W85-02069

ANALYSIS OF TOTAL PHOSPHORUS TRANSPORT IN RIVER SYSTEMS,
West Virginia Univ., Morgantown.
F. H. Verhoff, D. A. Melfi, and S. M. Yaksich.
Hydrobiologia, Vol. 91, p 241-252, July, 1982. 11 Fig, 8 Ref.

Descriptors: *Phosphorus, *Solute transport, *Path of pollutants, Sediment transport, Storm water, Nutrient transport, Nitrogen.

Human activities generate many pollutants from different land uses. These pollutants include nutrients (e.g., phosphorus and nitrogen), toxic substances (e.g., heavy metals and pesticides), and other substances (e.g., chlorides and salts). These materials often enter a river at some upstream point and are transported downstream by the flowing water. Many substances are transported both during storms and during normal river flow and often the major portion of the transport occurs during the storm. This paper considers the quantification of transport primarily during storms. First, the characteristics of storm transport are discussed. Then, a calculation method for estimating the distance of travel for sediment related materials is presented. Third, a technique to estimate the amount of a given chemical passing a point in a stream over a specified period of time is presented. The last part of this paper contains a technique for tracing the movement of substances through a river network. In particular, this procedure yields information as to the source of given pollutants over the entire storm period. (Author's abstract)
W85-02074

INFLUENCE OF WITHIN-STREAM DISTURBANCE ON DISSOLVED NUTRIENT LEVELS DURING SPATES,
Freshwater Biological Association, Wareham (England). River Lab.
H. Casey, and I. S. Farr.
Hydrobiologia, Vol. 92, p 447-462, July, 1982. 8 Fig, 1 Tab, 31 Ref. Department of the Environment contract DGR 480/309.

Descriptors: *Dissolved nutrients, *Spates, *Freshets, *Nutrients, Streams, Organic carbon, Phosphates, Silicates, Nitrates, Potassium, Suspended solids, Bacteria, Organic matter.

In rivers, variations in concentrations of many dissolved nutrients occur during spates. Increases are usually attributed to concentrated point or non-point inputs, and decreases to dilution associated with rainfall. Increased discharge disturbs sediments and benthic communities, but the effects of such disturbance on nutrient levels are difficult to isolate. Measurements of nutrient levels over three artificial spates revealed that substantial variations in dissolved organic carbon, dissolved phosphate, silicate, nitrate, and potassium levels could result from increased discharge in the absence of allochthonous inputs. Variations were closely related to peaks in suspended solids concentration or water height. Increases in biochemical oxygen demand and suspended bacteria also occurred. Variations in phosphate and silicate could be accounted for by a balance between release of 'sediment interstitial water' and exchange processes involving suspended and freshly exposed sediment. An increase in nitrate, during one spate, was due to a reduction in the effect of benthic denitrification. Small peaks in dissolved organic matter concentration were detected over each spate. We propose that within-stream disturbance is a factor which may contribute to variations in dissolved nutrient concentration during the rising hydrograph in natural spates. (Author's abstract)
W85-02089

AVAILABILITY OF DISSOLVED OXYGEN IN INTERSTITIAL WATERS OF A SANDY CREEK,
Indiana Univ. Northwest, Gary.
R. L. Whitman, and W. J. Clark.
Hydrobiologia, Vol. 92, p 651-658, July, 1982. 6 Fig, 1 Tab, 19 Ref.

Descriptors: *Interstitial water, *Dissolved oxygen, *Streams, *Mill Creek, *Texas, Conductivity, Alkalinity, Storm runoff, Convection, Base flow, Mixing, Thermal properties.

The chemical makeup of interstitial water is due to the combined influences of groundwater and surface waters. The possibility is examined of a thermally induced exchange mechanism for mixing of surface and subsurface waters in small, clean, sandy streams which display marked diurnal temperature fluctuations. Dissolved oxygen, pH, conductivity and alkalinity of surface and subsurface interstitial waters were investigated at Mill Creek (a small, rural, predominantly sandy stream in east Texas). Dissolved oxygen concentration tended to decrease with sediment depth, while conductivity and alkalinity did not significantly change with substrate depth. Surface water pH was significantly higher than interstitial water ($p = 0.05$). Chemical analyses of subsurface water from a pre- to post-storm event showed a depression in dissolved oxygen concentration in moderate and deep interstitial waters, immediately following the return of stream base flow, with the deeper strata returning to pre-storm oxygen levels four days later. A thermal convective current mechanism is proposed which would serve to transport surface water downward into these deeper interstices. The convective mechanism could influence the downward transport of organic material by helping to keep it in suspension. (Moore-IVI)
W85-02103

TWO-COMPONENT EXTREME VALUE DISTRIBUTION FOR FLOOD FREQUENCY ANALYSIS,
Naples Univ. (Italy). Dept. of Hydraulic Construction.
F. Rossi, M. Fiorentino, and P. Versace.
Water Resources Research, Vol. 20, No. 7, p 847-856, July, 1984. 7 Fig, 1 Tab, 44 Ref.

Descriptors: *Flood frequency, *Italy, *Two-component extreme value, Statistical analysis, Temporal distribution, Statistical models.

Theoretical considerations, supported by statistical analysis of 39 annual flood series (AFS) of Italian basins, suggest that the two-component extreme value (TCEV) distribution can be assumed as a parent flood distribution, i.e., one closely representative of the real flood experience. This distribution belongs to the family of distributions of the annual maximum of a compound Poisson process, which is a solid theoretical basis for AFS analysis. However, the two-parameter distribution of this family, obtained on the assumption of identically distributed floods, does not account for the high variability of both observed skewness and largest order statistics, so that a significant number of observed floods qualify as outliers under this distribution. The more general TCEV distribution assumes individual floods to arise from a mixture of two exponential components. Its four parameters can be estimated by the maximum likelihood method. A regionalized TCEV distribution, with parameters representative of a set of 39 Italian AFS's, was shown to closely reproduce the observed distribution of skewness and that of the largest order statistic. (Author's abstract)
W85-02151

MAXIMUM LIKELIHOOD ESTIMATES FOR THE PARAMETERS OF MIXTURE DISTRIBUTIONS,
Washington Univ., Seattle. Dept. of Civil Engineering.
K. M. Leytham.
Water Resources Research, Vol. 20, No. 7, p 896-902, July, 1984. 1 Fig, 5 Tab, 17 Ref. OWRT projects A-107-WASH and A-115-WASH.

Descriptors: *Estimating, *Water resources development, Floods, Streamflow, Monte Carlo method, Mathematical studies, Model studies, Mixtures.

Maximum likelihood estimates (MLEs) for the parameters of a mixture of two normal diributions are presented in terms of an expectation-maximization (EM) algorithm. Small sample properties of the parameter estimates are explored using Monte Carlo simulation. The EM algorithm has a number of attractive features. The algorithm is guaranteed to converge to a local if not a global maximum. Every iteration of the algorithm is guaranteed to increase the log likelihood. The iterative estimates always yield valid parameter values, that is, positive variance and mixing proportion betwen zero and one. Potential problems in the use of MLE's include the following. There may be singularities on the likelihood surface. In some situations the iterative algorithm will converge to parameter values associated with a singularity. Like all other currently available estimation procedures, the EM algorithm does not guarantee convergence to a global maximum. A global maximum can only be ensured by an exhaustive search of the mutidimensional likelihood surface. Little is known about the small-sample properties of the MLE's. Since hydrometeorologic records are generaly less than 50 years in length, the small sample properties of estimators are of concern. Although parameters estimated from unclassified data are inaccurate, quantiles derived from the fitted distributions are only slightly less accurate than quantiles estimated from classified data. This suggests that the ability to classify a sample may not be crucial for the wide range of problems in which quantiles are of principal concern. (Baker-IVI)
W85-02156

OBJECTIVE IDENTIFICATION OF POOLS AND RIFFLES,
State Univ. of New York at Buffalo. Dept. of Geography.
M. P. O'Neill, and A. D. Abrahams.
Water Resources Research, Vol. 20, No. 7, p 921-926, July, 1984. 8 Fig, 18 Ref.

Descriptors: *Pools, *Riffles, *Alluvial streams, Bed forms, Bed elevation, Mathematical studies, Channels, Dunes.

Alternating pools (deeps) and rifles (shallows) have come to be recognized as a fundamental morphological characteristic of alluvial stream channels. A new technique for objectively identifying pools and riffles is termed the bed form differencing technique. It has as its data base bed elevations surveyed at a fixed interval along the channel. Elevations are differenced, and the difference or

elevation change values are used to identify pools and riffles. Where the cumulative elevation change since the last bed form exceeds a certain tolerance value, a new bed form is considered to exist, the type of bed form being determined by the direction of the elevation change. The channel reach studied is located on Mansfield Creek, approximately 65 km south of Buffalo, NY. A well-developed pool-riffle sequence is evident along the full length of the reach. The most realistic pool-riffle sequence is obtained where the tolerance value is 0.75 times the standard deviation of the difference values. The bed form differencing technique can be used to identify bed forms other than pools and riffles, such as ripples and dunes, by simply modifying the surveying interval to reflect the scale of the bed forms. The technique is easy to apply insofar as the requisite data can be collected with a level, survey staff, and measuring tape, and the analysis involves only simple arithmetic. The technique produces results that are reproducible, realistic, and spatially consistent. (Moore-IVI)
W85-02159

ADDITIONAL TESTS ON THE EFFECT OF RAINFALL INTENSITY ON STORM FLOW AND PEAK FLOW FROM WILD-LAND BASINS,
Georgia Univ., Athens. School of Forest Resources.
J. D. Hewlett, J. C. Fortson, and G. B. Cunningham.
Water Resources Research, Vol. 20, No. 7, p 985-989, July, 1984. 5 Tab, 13 Ref.

Descriptors: *Rainfall intensity, *Storm runoff, *Flood peak, Drainage basins, Forest watersheds, Statistical studies, Perennial streams.

Hourly rainfall intensity has been found to have no appreciable effect on storm flows, and only a small effect on peak flows. A statistical analysis was carried out for 4094 storm events on 15 forested drainage basins ranging from 13 to 760 ha in area. The basins were in Kentucky (1), West Virginia (1), South Carolina (1), New Hampshire (1), Pennsylvania (1), Georgia (2), North Carolina (5), Arizona (1), Australia (1), and South Africa (1). The basins range from humid to semiarid climates and from flat to steep topography and contain various covers (forest, brush, grass, and swamp). About half of the basins tested showed significant response (0.05 level) to hourly rainfall intensity for both storm flow and peak flow. The marginal coefficient of determination accounted for by maximum hourly rain intensity averaged about 1% for storm flows and about 10% for peak flows. The dependence of storm flows on rain intensity did not increase in larger storms or on more responsive basins, but rather the opposite. Storm flow from wild-land basins supplying at least first-order perennial streams is little affected by hourly rainfall intensity. In the case of peak flows from such basins, intensity is effective in boosting channel-derived peaks, particularly on low-response basins, but is not a prime determiner of peak discharges on high-response basins. (Moore-IVI)
W85-02166

PHYSICALLY BASED FLOOD FREQUENCY DISTRIBUTION,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
M. A. Diaz-Granados, J. B. Valdes, and R. L. Bras.
Water Resources Research, Vol. 20, No. 7, p 995-1002, July, 1984. 9 Fig, 2 Tab, 19 Ref.

Descriptors: *Flood frequency, *Frequency distribution, Probability distribution, Forecasting, Frequency analysis, Mathematical studies.

The geomorphoclimatic instantaneous unit hydrograph theory, the joint probability density function of storm duration and intensity, and Philip's representation of the infiltration process are used to derive a flood frequency distribution that could be used in regions with no streamflow records. The distribution requires storm, soil, and geomorphologic characteristics which in principle may be evaluated from climatic records, field observations, and/or remote sensing. The model was applied to two basins, one representative of an arid climate and the other of a wet climate, with reasonable results. The resulting flood frequency distribution is in analytical form containing only few climatologic and physiographic parameters of the catchment. (Baker-IVI)
W85-02168

2F. Groundwater

CHANGE IN QUALITY OF THERMAL GROUNDWATER FROM A UNIQUE RESOURCE IN LEBANON,
American Univ., Beirut (Lebanon). Dept. of Environmental Health.
A. Acra, R. Milki, and Y. Karahagopian.
International Journal of Environmental Studies, Vol. 19, No. 1, p 63-68, 1982. 1 Fig, 2 Tab, 13 Ref.

Descriptors: *Lebanon, *Summaqiyeh, *Thermal water, *Groundwater, *Physicochemical characteristics, Water temperature, Hardness, Corrosivity.

Thermal groundwaters were not known in Lebanon until 1968, when a 550 m deep artesian well was drilled into the Cenomanian limestone aquifer occuring at a depth of 485 m. The well is located close to Summaqiyeh village in the northern part of Akkar plain. The stored groundwater was initially at a temperature of about 43 C. The physicochemical quality of the water was monitored during a six year period from 1970 to 1975. This groundwater had a mean temperature of 41.35 degrees C, a relatively high mineral content, and a marked corrosive property. It is inferred from these characteristics and the occurrence of the aquifer in a volcanic region that the water is of magmatic origin. Changes in the physico-chemical characteristics of the thermal groundwater over time indicate contamination of the aquifer due to infiltration by groundwater in the region through a corroded well casing and do not indicate infiltration by seawater. (Collier-IVI)
W85-01673

CLASSIFICATION AND DESCRIPTION OF DOLOMITIC FABRICS OF ROCKS FROM THE FLORIDAN AQUIFER, U.S.A.,
Florida Univ., Gainesville. Dept. of Geology.
A. F. Randazzo, and L. G. Zachos.
Sedimentary Geology, Vol. 37, No. 3, p 151-162, 1983/1984. 8 Fig, 1 Tab, 9 Ref.

Descriptors: *Floridan Aquifer, *Florida, *Dolomites, Geologic formations, Mineralogy, Lithology.

Biozones of the Lake City Formation, Avon Park Formation and Ocala Limestone are characterized by interbedded, massive, fossiliferous carbonate rocks (wackestones to grainstones) and thinly bedded, peloidal and carbonaceous rocks (mudstones and wackestones). Several horizons have been partly or completely dolomitized. A wide range of early to late stages of dolomitic fabrics are recognized. The fabrics are classified descriptively as equigranular (unimodal) or inequigranular (multimodal). Fabrics composed of crystals < 0.002 mm in diameter (unresolvable) are termed aphanotopic. Equigranular fabrics include sutured mosaic and sieve mosaic fabrics, and a somewhat problematic fabric. Inequigranular fabrics include porphyrotopic, poikilotopic, fogged mosaic and spotted mosaic fabrics. Two processes of dolomitization are suggested: (a) homogeneous dolomitization resulting in a single-stage development of microtextured (groundmass crystals < 0.016 mm in diameter) aphanotopic, peloidal and mosaic fabrics; and (b) heterogeneous dolomitization resulting in multistage development of porphyrotopic and some mosaic fabrics. It is possible to deduce the original depositional fabric and lithofacies from the dolomitic fabric except where extensive neomorphism has occurred. (Author's abstract)
W85-01733

WATER-LEVEL CHANGES IN THE HIGH PLAINS REGIONAL AQUIFER, NORTHWESTERN OKLAHOMA, PREDEVELOPMENT TO 1980,
Geological Survey, Oklahoma City, OK. Water Resources Div.
J. S. Havens.
USGS Water-Resources Investigations Report 83-4073, 1983. 1 Map sheet, 1 Fig, 8 Ref.

Descriptors: *Aquifers, *Water table, *Oklahoma, *Maps, *High Plains Regional Aquifer System.

The High Plains aquifer in Oklahoma is part of a regional aquifer system extending from South Dakota southward to Texas and New Mexico. The principal aquifer, the Ogallala Formation of Tertiary age, is hydraulically connected with other unconsolidated deposits, principally of Quaternary age. During 1978, the U.S. Geological Survey began a 5-year study of the High Plains regional aquifer system to provide hydrologic information for evaluation of the aquifer and to develop predictive computer models of it. This report consists of a map showing the water-level changes from predevelopment to 1980 in the High Plains aquifer in Oklahoma, approximately 40 years after irrigation began in the Oklahoma Panhandle. Water-level declines of more than 100 feet have occurred southeast of Guymon, in Texas County. Lesser declines have occurred northeast, northwest, and southwest of Guymon. These declines reflect the areas of greatest ground-water withdrawal. Smaller areas of 100-foot declines have occurred in Woodward and Ellis Counties. An area of 50-foot water-level rise has occurred east of Boise City in Cimarron County. (USGS)
W85-01771

WATER RESOURCES OF THE FORT UNION COAL REGION, EAST-CENTRAL MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
S. E. Slagle.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4151, December 1983. 37 p, 9 Fig, 4 Tab, 82 Ref.

Descriptors: Groundwater, *Groundwater availability, Surface water, Water quality, *Montana, Williston Basin, Fort Union Formation.

The shallow ground-water system in the Fort Union coal region overlies the Upper Cretaceous Bearpaw Shale. It includes the Upper Cretaceous Fox Hills Sandstone and the overlying Hell Creek Formation, Paleocene Fort Union Formation, and Pleistocene and Holocene glacial deposits, terrace deposits, and alluvium. Two general flow patterns are present in aquifers above the Hell Creek Formation and a third may occur in the Fox Hills-lower Hell Creek aquifer. Recharge to the shallow ground-water system from direct infiltration of snowmelt and rainfall is about 50,000 acre-ft/yr. Discharge from the system is to perennial streams (about 5,000 acre-ft/yr to the Redwater River), withdrawal by wells (about 2,000 acre-ft/yr for livestock use and 2,500 acre-ft/yr for domestic use), and 34 to 45 in./yr to evapotranspiration. Primary constituents in water above the Hell Creek Formation are sodium, bicarbonate, and sulfate, and dissolved-solids concentrations are about 1,800 mg/L; water below a depth of about 200 feet contains more sodium and bicarbonate. Water in the Fox Hills-lower Hell Creek aquifer has an average dissolved-solids concentration of 1,180 mg/L. Flows in most streams have large seasonal variations, with the largest flows occurring in the spring as a result of snowmelt and rainfall. Dissolved-solids concentrations of streams generally are largest during low flow and smallest during high flow. Concentrations ranged from 160 to 6,960 mg/L in small streams and from 400 to 600 mg/L in the Missouri and Yellowstone Rivers. (USGS)
W85-01772

GEOHYDROLOGY OF THE MEADOWBROOK ARTIFICIAL-RECHARGE PROJECT SITE IN EAST MEADOW, NASSAU COUNTY, NEW YORK,

Geological Survey, Albany, NY. Water Resources Div.
D. A. Aronson, J. B. Lindner, and B. G. Katz.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report, 1983. 44 p, 19 Fig, 8 Tab, 34 Ref.

Descriptors: *Groundwater recharge, *Induced infiltration, *Groundwater movement, *Reclaimed water, Water quality, Recharge basins, Injection wells, Computer models, *Long Island, Recharge facilities, Index materials, *New York.

In Nassau and Suffolk Counties, where the quality and quantity of potable ground water has declined as the result of urbanization, the use of reclaimed wastewater to replenish the ground-water reservoir is technically feasible. A system of 11 recharge basins and 5 shallow injection wells will return 4 million gallons per day of reclaimed wastewater to the ground-water reservoir. Results of a two-dimensional flow analysis of pump-test data were incorporated into a finite-difference regional flow model to predict changes in head from artificial recharge in and around the recharge site. A maximum water-table rise of 17 feet is predicted beneath the recharge basins under 'worst-case' conditions; buildups will be somewhat higher near the injection wells. The predicted maximum increase in streamflow at East Meadow Brook is 3.5 cubic feet per second. The projected chemical quality of the treated effluent to be used for aquifer recharge will be superior to that of water already present in the upper part of the ground-water reservoir at the recharge site. Therefore, the recharge effort should improve both the quantity and quality aspects of the ground-water in the vicinity of the recharge site. (USGS)
W85-01774

GENERALIZED ALTITUDE AND CONFIGURATION OF THE WATER TABLE IN PARTS OF LARIMER, LOGAN, SEDGWICK, AND WELD COUNTIES, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
R. G. Borman, and N. G. Gaggiani.
USGS Water-Resources Investigations Report 82-4055, 1983. 1 Map sheet, 2 Fig, 8 Ref.

Descriptors: *Groundwater, *Water table, Unconfined aquifers, Geologic formations, *Colorado, Ogallala Formation, White River Formation.

The water table in parts of Larimer, Logan, Sedgwick, and Weld Counties, Colorado ranges from about 7,000 feet above the National Geodetic Vertical Datum of 1929 (formerly called mean sea level) in eastern Larimer County to about 3,450 feet in northeastern Sedgwick County. Water is moving to the south and southeast in much of the study area. (USGS)
W85-01775

EXPLORATORY DRILLING AND AQUIFER TESTING AT THE KIPAHULU DISTRICT HALEAKALA NATIONAL PARK, MAUI, HAWAII,
Geological Survey, Honolulu, HI. Water Resources Div.
W. R. Souza.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4066, 1983. 21 p, 6 Fig, 3 Tab, 3 Ref.

Descriptors: Drilling, *Aquifer testing, Confined groundwater, Perched groundwater, Groundwater recharge, *Well hydrograph, *Discharge hydrograph, *Hawii, Maui.

An exploratory well, located at 388 feet above sea level in Kipahulu Valley on Maui, Hawaii, was completed and tested in October 1980. The 410-foot well penetrates a series of very dense basaltic lava flows of the Hana Formation. At an elevation of 10 feet above mean sea level, the well penetrated a water-bearing zone of permeable basaltic rock. Water from this zone had a head of about 76 feet above sea level. In October of 1980, the well was pump tested for 9 hours at various discharge rates up to 350 gallons per minute with a maximum drawdown of about 12 feet. Based on the test data, the well should produce water at a rate of 200 gallons per minute with a drawdown of less than 3 feet. The water level in the well was continuously monitored from October 1980 to mid-November 1981, during which period a maximum decline of 20 feet was recorded. Water level fluctuations in the well can be correlated to the flow in nearby Palikea Stream. The long-term water level in the well should stabilize at about 75 feet above sea level. Water quality was excellent. The total dissolved-solids content was 49 milligrams per liter and the chloride content was 4.2 milligrams per liter. (USGS)
W85-01776

GROUND WATER IN THE TWENTY-NINE PALMS INDIAN RESERVATION AND VICINITY, SAN BERNARDINO COUNTY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
J. R. Freckleton.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, Price: $7.50 in paper copy, $4.00 in microfiche. USGS Water Resources Investigations Report 82-4060, October 1982. 46 p, 2 Fig, 6 Tab, 10 Ref.

Descriptors: *Groundwater, Hydrology, Geology, Drillers logs, Chemical analysis, Yield, Well, Precipitation, *California, Twenty-Nine Palms Indian Reservation, San Bernardino County.

The Twenty-Nine Palms Indian Reservation is in San Bernardino County, California. Movement of ground water in the area is impeded locally by faults which act as ground-water barriers. There are indications that a fault probably crosses the reservation in an east-west direction; such a fault may interfere with ground-water pumping. The water-table altitude near the northern boundary of the reservation is estimated to be 120 to 130 feet below land surface datum; the aquifer thickness in the area is unknown. Pumping-test results for wells near the reservation show specific capacities ranging from 9.2 to 70.0 gallons per minute per foot of drawdown. Wells drilled on the reservation would probably fall within this range. Sodium concentrations, which may pose a hazard to those who must restrict its intake, and excessive fluoride are present in water samples from wells near the reservation. High sodium and fluoride concentrations are probably present in water in the saturated material underlying the reservation. (USGS)
W85-01779

TRUE LOCATION AND ORIENTATION OF FRACTURES LOGGED WITH THE ACOUSTIC TELEVIEWER (INCLUDING PROGRAMS TO CORRECT FRACTURE ORIENTATION),
Geological Survey, Denver, CO. Water Resources Div.
R. A. Kierstein.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water Resources Investigations Report 83-4275, 1984. 73 p, 14 Fig, 7 Tab, 8 Ref.

Descriptors: *Computor programs, Geologic fractures, Well logs, Logging, Televiewer, *Magnetometer, Hole deviation, *Fracture attitude.

The attitude of fractures measured on acoustic-televiewer logs may be misorientated by as much as 180 degrees in a drill hole that is deviated significantly from vertical, because of the effect of the vertical component of the magnetic field on the tilted magnetometer that is used to orient the log. A method has been developed to correct for the misorientation by analyzing the orientation of the magnetometer with respect to the magnetic-field vector acting at the magnetometer's center. Computer programs were written to correct the attitude of fractures for both magnetic effects and hole deviation. For the reorientation of a single fracture, a stereographic solution is illustrated. Test results suggest that the fracture orientation can be corrected to plus or minus five degrees of true orientation, provided there are no other magnetic effects, such as magnetite in the rocks. (USGS)
W85-01780

EFFECTS OF THE DROUGHT OF 1980-81 ON STREAMFLOW AND ON GROUND-WATER LEVELS IN GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01783

GROUND-WATER QUALITY IN THE WESTERN SNAKE RIVER BASIN, SWAN FALLS TO GLENNS FERRY, IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
D. J. Parliman.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4062, 1983. 85 p, 19 Fig, 11 Tab, 40 Ref.

Descriptors: *Water quality, Water quality standards, *Groundwater, *Baseline studies, *Aquifers, Chemical analysis, *Hydrogeology, Water wells, Elmore County, *Idaho, Owyhee County, Bruneau River, Mountain Home, Western Snake River basin, Snake River valley.

Water-quality data were collected from 92 wells in the western Snake River basin, Swan Falls to Glenns Ferry, Idaho. Current data were compiled with pre-1980 data from 116 wells to define water-quality conditions in major aquifers. Factors affecting water quality are composition of aquifer materials, water temperature, and source of recharge. Mixing of water by interaquifer flow, from confined, hot water aquifers (40 degrees Celsius or greater) with water from cold water aquifers (less than 20 degrees Celsius) occurs along regional complex fault systems, and through partially cased boreholes. Cold water generally contains calcium, magnesium, and bicarbonate plus carbonate ions; hot water generally contains sodium, potassium, and bicarbonate plus carbonate ions. Warm water (between 20 degrees and 40 degrees Celsius) has an intermediate chemical composition resulting from mixing. Ground-water quality is acceptable for most uses, although it locally contains chemical constituents or physical properties that may restrict its use. Effects of thermal water used for irrigation on quality of shallow ground water are inconclusive. Long-term increase in concentrations of several constituents in parts of the study area may be due to effects of land- and water-use activities, such as infiltration of septic-tank effluent. (USGS)
W85-01784

REGIONAL GEOHYDROLOGY OF THE NORTHERN LOUISIANA SALT-DOME BASIN, PART III, POTENTIOMETRIC LEVELS OF THE WILCOX-CARRIZO AND SPARTA AQUIFERS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
G. N. Ryals.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS WRI Report 83-4131, 1983. 10 p, 5 Fig, 1 Tab, 10 Ref.

Descriptors: *Maps, *Potentiometric level, Aquifers, Contours, Water-level fluctuations, Well hydrographs, *Louisiana, Wilcox-Carrizo aquifer, Sparta aquifer.

The potentiometric surface of the Wilcox-Carrizo aquifer in northwestern Louisiana is shown by contours using data collected from 1960-80. The aquifer is not affected by regional water-level declines, as no large pumping centers have been developed. Seasonal water-level fluctuations shown by the hydrographs of seven wells are generally less than 10 feet annually. The spring 1980 potentiometric surface of the Sparta aquifer in northern Louisiana and southern Arkansas is shown by contours. Water-level measurements in Arkansas were made March 18-21, 1980, and in

Louisiana, May 19-21, 1980. Intensive pumping of the aquifers throughout northern Louisiana and southern Arkansas has caused a regional lowering of water levels. This regional water-level decline is shown by the hydrographs of six wells. (USGS)
W85-01785

COMPUTER PROGRAM AND DATA LISTING FOR TWO-DIMENSIONAL GROUND-WATER MODEL FOR LARAMIE COUNTY, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-01787

MACHINE-READABLE DATA FILES FROM THE MADISON LIMESTONE AND NORTHERN GREAT PLAINS REGIONAL AQUIFER SYSTEM ANALYSIS PROJECTS, MONTANA, NEBRASKA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-01790

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE BLOOMFIELD COAL TRACT, DAWSON COUNTY, EASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
M. R. Cannon.
Available from OFSS, USGS, Box 25425, Fed, Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4229, December 1983. 33 p, 6 Fig, 3 Tab, 29 Ref.

Descriptors: *Coal mines, Hydrology, Fort Union coal region, *Montana, *Mining impacts.

The Bloomfield coal tract in Dawson County, Montana, contains about 420 million tons of recoverable coal reserves within the Pust coal bed. About 136 million tons of coal within the tract is Federally owned, of which 98 million tons has been identified for potential lease sale. A hydrologic study has been conducted in the potential lease area to describe existing hydrologic systems and to assess potential impacts of surface coal mining on local water resources. Shallow ground-water resources in the tract are limited to sandstone and coal aquifers in the Tongue River Member of the Fort Union Formation (Paleocene age). These shallow aquifers have small values of hydraulic conductivity; yields to wells generally range from 1 to 10 gallons per minute. Water from shallow sandstone and coal aquifers is used primarily for livestock watering and domestic supply. Chemical analyses indicate that water from most shallow aquifers is dominated by calcium and magnesium cations and sulfate and bicarbonate anions. Surface-water resources in the tract consist primarily of small reservoirs used for livestock watering. All streams in the tract are ephemeral, making them unreliable as a source of livestock water. Mining of the Pust coal bed would cause certain impacts on local water resources. About 15 stock and domestic wells and 13 small stock reservoirs would be destroyed by mining. Shallow coal and sandstone aquifers would be permanently removed from parts of the tract. Leaching of soluble salts from mine spoils may cause a long-term degradation of the quality of water in shallow aquifers in or near the coal tract. Impacts on the local water resources could be mitigated by development of alternative ground-water supplies from deeper aquifers in the Fort Union and in the Upper Cretaceous Hell Creek and Fox Hills Formations. Reservoirs destroyed by mining could be reconstructed during mine reclamation. (USGS)
W85-01791

MAJOR INSTITUTIONAL ARRANGEMENTS AFFECTING GROUND WATER IN NEW YORK STATE,
Cornell Univ., Ithaca, NY. Dept. of City and Regional Planning.
For primary bibliographic entry see Field 6E.
W85-01802

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN CHAMBERS, LIBERTY, AND MONTGOMERY COUNTIES, TEXAS, 1975-79,
Geological Survey, Austin, TX. Water Resources Div.
K. W. Ratzlaff, W. B. Lind, and C. E. Ranzau.
Texas Department of Water Resources Report 280, Austin, September 1983. 37 p, 3 Fig, 11 Tab, 5 Ref.

Descriptors: *Groundwater, Drillers' logs, *Water levels, *Chemical analyses, *Texas, Chambers County, Liberty County, Montgomery County.

Information on major new water wells in Chambers, Liberty, and Montgomery Counties was compiled by the U.S. Geological Survey from 1975 to 1979. This report presents the results of the hydrologic data collection on new large-capacity and other selected wells, including well location and completion data, drillers' logs of the strata penetrated, water levels, and chemical quality of the produced water. These water-well data are supplementary to similar data on older wells in these countries and descriptive evaluations of the ground-water resources which have been published previously. (USGS)
W85-01818

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN BRAZORIA, FORT BEND, AND WALLER COUNTIES, TEXAS, 1975-79,
Geological Survey, Austin, TX. Water Resources Div.
K. W. Ratzlaff, C. E. Ranzau, and W. B. Lind.
Texas Department of Water Resources, Austin, Report 277, July 1983. 55 p, 3 Fig, 12 Tab, 5 Ref.

Descriptors: *Ground water, Drillers' logs, Water levels, *Chemical analyses, *Texas, Brazoria County, Fort Bend County, Waller County.

Information on major new water wells in Brazoria, Fort Bend, and Waller Counties was compiled by the U.S. Geological Survey from 1975 to 1979. This report presents the results of the hydrologic data collection on new large-capacity and other selected wells, including well location and completion data, drillers' logs of the strata penetrated, water levels, and chemical quality of the produced water. These water-well data are supplementary to similar data on older wells in these counties and descriptive evaluations of the ground-water resources which have been published previously. (USGS)
W85-01819

GUIDE TO NORTH DAKOTA'S GROUND-WATER RESOURCES,
Geological Survey, Bismarck, ND. Water Resources Div.
Q. F. Paulson.
Available from the Distr. Br., USGS, 604 S. Pickett St., Alex., VA 22304. USGS Water-Supply Paper 2236, 1983. 25 p, 30 Fig, 6 Tab, 18 Ref.

Descriptors: *Groundwater availability, *Groundwater quality, *Groundwater contamination, *Groundwater management, Groundwater hydrology, Surface-groundwater relations, Water use, Water law, *North Dakota.

More than 60 percent of North Dakota's population uses ground water for one purpose or another. The State has a good potential for further groundwater development based on information collected in county ground-water studies during the past 25 years. However, the development will involve difficult problems because of salinity, uneven distribution of aquifers, and insufficient aquifer recharge (replenishment). The solution to these and other complex geohydrologic problems will require sound management practices using modern technology including computer modeling of aquifers. The most productive aquifers consist of linear-shaped bodies of sand and gravel that were deposited from melting glaciers some tens of thousands of years ago. Yields from these aquifers, which occur mostly north and east of the Missouri River, are commonly between 50 and 500 gallons a minute, and, in places, exceed 500 gallons a minute. Ground water also is obtainable from sandstone, lignite, and limestone aquifers in the bedrock. The ground water generally is bacterially safe and has not been affected by toxic wastes. However, in some parts of North Dakota the ground water is so mineralized or saline that is only of limited use. (USGS)
W85-01824

INSTRUMENTATION USED FOR HYDRAULIC TESTING OF POTENTIAL WATER-BEARING FORMATIONS AT THE WASTE ISOLATION PILOT PLANT SITE IN SOUTHEASTERN, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7B.
W85-01827

FLUORIDE, NITRATE, AND DISSOLVED-SOLIDS CONCENTRATIONS IN GROUND WATERS OF WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
W. E. Lum, II, and G. L. Turney.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 82-508, 1981. 4 Map Sheets, 4 Fig, 8 Ref.

Descriptors: *Groundwater, *Nitrate, *Dissolved solids, *Fluoride, Geochemistry, Chemical quality, Water quality, *Maps, *Washington, Groundwater region designations, Groundwater contamination.

This study provides basic data on ground-water quality throughout the State. It is intended for uses in planning and management by agencies and individuals who have responsibility for or interest in, public health and welfare. It also provides a basis for directing future studies of ground-water quality toward areas where ground-water quality problems may already exist. The information presented is a compilation of existing data from numerous sources including: the Washington Departments of Ecology and Social and Health Services, the Environmental Protection Agency, as well as many other local, county, state and federal agencies and private corporations. Only data on fluoride, nitrate, and dissolved-solids concentrations in ground water are presented, as these constituents are among those commonly used to determine the suitability of water for drinking or other purposes. They also reflect both natural and man-imposed effects on water quality and are the most readily available water-quality data for the State of Washington. The percentage of wells with fluoride, nitrate, or dissolved-solids concentrations exceeding U.S. Environmental Protection Agency Primary and Secondary Drinking Water Regulations were about 1, about 3, and about 3, respectively. Most high concentrations occurred in widely separated wells. Two exceptions were: high concentrations of nitrate and dissolved solids in wells on the Hanford Department of Energy Facility and high concentrations of nitrate in the lower Yakima River basin. (USGS)
W85-01828

DEVELOPING THE RESOURCE POTENTIAL OF A SHALLOW WATER TABLE,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 3B.
W85-01832

WATER RESOURCES DATA, KENTUCKY, WATER YEAR 1982,
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01923

THREE-DIMENSIONAL DIGITAL-COMPUTER MODEL OF THE PRINCIPAL GROUNDWATER RESERVOIR OF THE SEVIER DESERT, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-01925

WATER-LEVEL MAPS OF THE ALLUVIAL AQUIFER, NORTHWESTERN MISSISSIPPI, APRIL, 1982,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-01926

ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO, 1982,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01927

DATA FOR GROUND-WATER TEST HOLE NEAR NICOLAUS, CENTRAL VALLEY AQUIFER PROJECT, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-01929

HYDROLOGIC MAPS OF THE HIGH PLAINS AQUIFER, JANUARY 1981, SOUTHWESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-01930

WATER RESOURCES DATA, IOWA, WATER YEAR 1982,
Geological Survey, Iowa City, IA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01931

WATER RESOURCES DATA, KANSAS WATER YEAR 1982,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01932

WATER RESOURCES DATA, NEW HAMPSHIRE AND VERMONT, WATER YEAR 1982,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01933

WATER RESOURCES DATA, ARKANSAS, WATER YEAR 1982,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01934

WATER RESOURCES DATA, MASSACHUSETTS AND RHODE ISLAND, WATER YEAR 1982,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01935

WATER RESOURCES DATA, NORTH DAKOTA, WATER YEAR 1982,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01936

WATER RESOURCES DATA, SOUTH CAROLINA, WATER YEAR 1982,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01937

WATER RESOURCES DATA, GEORGIA, WATER YEAR 1982,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01938

WATER RESOURCES DATA, ALABAMA, WATER YEAR 1982,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01939

TRENDS AND FLUCTUATIONS IN THE POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER, WEST-CENTRAL FLORIDA, 1961-80,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-01940

DATA FOR GROUND-WATER TEST HOLE NEAR BUTTE CITY, CENTRAL VALLEY AQUIFER PROJECT, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-01941

WATER-LEVEL MAPS OF THE ALLUVIAL AQUIFER IN NORTHWESTERN MISSISSIPPI, APRIL 1983,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-01944

SHALLOW GROUND-WATER FLOW AND DRAINAGE CHARACTERISTICS OF THE BROWN DITCH BASIN NEAR THE EAST UNIT, INDIANA DUNES NATIONAL LAKESHORE, INDIANA, 1982,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 4A.
W85-01948

MAJOR AQUIFERS IN MINER COUNTY, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
S. D. McGarvie.
South Dakota, Dept. of Water and National Resources, (Vermillion), Information Pamphlet No. 20, 1983. 10 p, 3 Fig, 1 Tab.

Descriptors: *Aquifers, Hydrogeology, *Groundwater, Water quality, *South Dakota, Miner County.

Outwash sand and gravel occurs throughout Miner County, S.D., at depths ranging from 0 to 500 feet below land surface. In places, the deposits are hydrologically connected and form major glacial aquifers. The Floyd aquifer underlies about 180 square miles of Miner County at depths ranging from 25 to 150 feet below land surface. Thickness ranges from 10 to 100 feet and wells may yield as much as 1,200 gallons per minute. Other outwash aquifers under lie an additional 195 square miles of Miner County. The Niobrara Formation is the uppermost bedrock aquifer in the county and underlies all but its southwest corner. The Niobrara is found at depths ranging from 60 to 600 feet below land surface. Thickness of the formation ranges from 10 to 120 feet. The Codell Sandstone Member of the Carlile Shale underlies the Niobrara Formation throughout the county at depths ranging from 120 to 720 feet below land surface. Thickness of the Codell ranges from 10 to 100 feet. The Dakota Sandstone underlies most of the northwest half of Miner County. Depth to the Dakota ranges from 350 to 1,000 feet below land surface and thickness ranges from 10 to 400 feet. The Dakota Sandstone is underlain by the Sioux Quartzite which contains relatively large amounts of water in joints and fractures. Each of the aquifers in Miner County provides adequate supplies of water for domestic and stock use. The Floyd aquifer offers the greatest potential for irrigation or other large-yield development. (USGS)
W85-01950

FEASIBILITY STUDY OF DEVELOPING VALLEY-FILL AQUIFERS FOR VILLAGE WATER SUPPLIES IN SOUTHERN GUAM,
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
J. F. Ayers, and R. N. Clayshulte.
Technical Report No. 41, September, 1983. 96 p, 6 Fig, 8 Tab, 10 Ref. Project No. OWRT A-027-GUAM(1), Contract/Grant No. 13-34-0001-2112.

Descriptors: *Alluvial aquifers, *Water supply development, *Groundwater potential, *Rural areas, Alluvium, Marine sediments, Aquifers, Irrigation wells, Groundwater irrigation, Geophysics, Seismology, Resistivity, *Guam.

Villages located in southern Guam occasionally experience domestic water supply shortages that affect both the home dweller and the farmer. Municipal water supplies are provided by the island-wide distribution system. Water is obtained from well fields which tap the complex Ghyben-Herzberg lens beneath the northern limestone plateau and is transported south at considerable cost. If alternative sources of freshwater can be located near the centers of high demand, the energy costs of pumping water long distances would be lowered, the reliability of the distribution system would be improved, the quantity of water extracted from the northern lens would be reduced, and lastly the village communities would become more self-sufficient in terms of water supply. Potential sources of groundwater sources of groundwater for domestic use have been identified near the outflow of the Inarajan River. Two water-bearing units of alluvium and shallow-water marine sediments overlie a partially weathered volcanic basement. From the results of the study it appears feasible to develop the groundwater resource, at least initially, on a limited scale. The quality of the product water is such that it could be used directly for agriculture purposes.
W85-02026

DIAGENESIS AND PORE-SPACE EVOLUTION WITHIN RECENT AND PLEISTOCENE CARBONATE UNITS OF OROTE PENINSULA, GUAM,
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
R. N. Clayshulte, and J. F. Ayers.
Technical Report No. 47, December, 1983. 119 p, 7 Fig, 11 Tab, 35 Ref, 2 Append. Project No. OWRT A-025-GUAM(1), Contract/Grant No. 14-34-0001-2112.

Descriptors: *Carbonates, *Diagenesis, Porosity, Limestone, Reefs, Carbonate rocks, Lithification, Sedimentation, Groundwater, Vadose water, Marine geology, Aquifers, Porous media, *Guam, Orote Peninsula.

The Mariana limestone on Orote Peninsula has undergone diagenetic modification under marine phreatic, freshwater and freshwater vadose conditions. Marine diagenetic modification from internal sediment fill, submarine cementation and borings have produced partial to complete occlusion of primary interparticle porosity. Marine sediments are lithified by cements similar to those found in the modern reef complex. Within the freshwater phreatic environment, nearly all interparticle porosity is occluded with some secondary porosity generation. There has also been preferential disso-

lution of, primarily, aragonitic clasts, which creates distinctive moldic porosity. There is only minor diagenetic alternation within the freshwater vadose environment.
W85-02027

HYDROGEOLOGIC INVESTIGATION OF AGANA SWAMP NORTHERN GUAM,
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
J. F. Ayers, and R. N. Clayshulte.
Technical Report No. 40, September, 1983. 30 p, 6 Fig, 1 Tab, 10 Ref. Project No. OWRT A-026-GUAM(1), Contract/Grant No. 14-34-0001-2112.

Descriptors: *Geohydrology, *Swamps, *Carbonates, *Groundwater movement, Groundwater, Groundwater basins, Aquifers, Groundwater potential, Geophysics, Seismology, Limestone, Carbonate rocks, *Guam, Agana Swamp.

An attempt was made to investigate the hydraulic relationship between Agana Swamp, located near the village of Agana, and the freshwater lens beneath the limestone plateau of northern Guam. A number of problems developed during the course of the study which prompted a change in the project objectives. The main problems were access to the study area and artificial features which prevented the full application of geophysical surveys and the installation of an observation-well network. The study, however, points out a number of aspects such as the general geology and physiography of the swamp area, its drainage characteristics, and the occurrence of groundwater. In addition, the results of the investigation have been useful in constructing a set of guidelines for further study.
W85-02029

ALTITUDE OF THE TOP OF THE MATAWAN GROUP-MAGOTHY FORMATION, SUFFOLK COUNTRY, LONG ISLAND, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7B.
W85-02030

GEOHYDROLOGIC DATA FOR TEST WELL USW G-4, YUCCA MOUNTAIN AREA, NYE COUNTY, NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-02031

DATA FOR GROUND-WATER STUDIES OF THE SAN JUAN BASIN, NEW MEXICO (1982-83),
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-02034

APPRAISAL OF WATER FROM SURFICIAL-OUTWASH AQUIFERS IN TODD COUNTY AND PARTS OF CASS AND MORRISON COUNTIES, CENTRAL MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 4B.
W85-02038

AQUIFER TESTS IN THE STRATIFIED DRIFT, CHIPUXET RIVER BASIN, RHODE ISLAND,
Geological Survey, Providence, RI.
D. C. Dickerman.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4321, 1984. 39 p, 16 Fig, 7 Tab, 24 Ref.

Descriptors: *Aquifer, Aquifer test, *Transmissivity, *Hydraulic conductinity, *Storage coefficient, *Specific yield, Chipuxet River groundwater reservoir, *Stratified drift, *Rhode Island.

Analyses of 18 aquifer tests in the Chipuxet River basin in southern Rhode Island indicate that the stratified-drift this aquifer is generally highly transmissive and would yield large quantities of water to properly constructed wells. The aquifer is an irregularly shaped body of coarse sand and gravel deposited by glacial streams during the last Pleistoicene ice advance. This heterogenous, anisotropic water-table aquifer is composed of stratified drift consisting of complexly interbedded lenses of sand and gravel and subordinate amounts of silt and silty sand. The tests were made in the thick, permeable parts of the stratified drift, which forms a major ground-water reservoir in the lower reaches of the Chipuxet River basin. The analytical method most often used, and whose assumptions closely approximate field conditions, was a method by R. W. Stallman intended for vertical movement in an unconfined, anisotropic aquifer. The transmissivity of the stratified-drift aquifer ranged from 5,000 to 39,100 square feet per day. The horizontal hydraulic conductivity ranged from 90 to 595 feet per day, and the vertical hydraulic conductivity ranged from 3 to 52 feet per day. The ratio of vertical to horizontal hydraulic conductivity of the stratified-drift aquifer ranged from 1:5 to 1:80. (USGS)
W85-02039

RECHARGE AND DISCHARGE AREAS OF THE FLORIDAN AQUIFER IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT AND VICINITY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-02049

ALTITUDE AND GENERALIZED CONFIGURATION OF THE TOP OF THE FLORIDAN AQUIFER, ST. JOHNS COUNTY, FLORIDA,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-02050

HYDROGEOLOGY OF WELL-FIELD AREAS NEAR TAMPA, FLORIDA, PHASE 2--DEVELOPMENT AND DOCUMENTATION OF A QUASI-THREE-DIMENSIONAL FINITE-DIFFERENCE MODEL FOR SIMULATION OF STEADY-STATE GROUND-WATER FLOW,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. B. Hutchinson.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. Water-Resources Investigations Report 84-4002, 1984. 174 p, 40 Fig, 9 Tab, 29 Ref.

Descriptors: *Computer models, *Groundwater movement, *Hydrogeology, *Water management (applied), Pumping, *Evapotranspiration, Tampa, Hillsborough County, *Florida.

This report describes a quasi-three-dimensional finite-difference model for simulation of steady-state ground-water flow in the Floridan aquifer over a 932-square-mile area that contains 10 municipal well fields. The over-lying surficial aquifer contains a water table and is coupled to the Floridan aquifer by leakage term that represents flow through a confining layer separating the two aquifers. Under the steady-state condition, all storage terms are set to zero. Use of the head-controlled flux condition allows simulated head and flow changes to occur in the Floridan aquifer at the model boundaries. Procedures used to calibrate the model, test its sensitivity to input-parameter errors, and validate its accuracy for predictive purposes are described. Also included are attachments that describe setting up and running the model. Example model-interrogation runs show anticipated drawdowns under high, average, and low recharge conditions with 10 well fields pumping simultaneously at the maximum annual permitted rates totaling 186.9 million gallons per day. (USGS)
W85-02052

INFLUENCE OF SIMULATED GROUNDWATER-MOVEMENT ON THE PHOSPHORUS RELEASE FROM SEDIMENTS, AS MEASURED IN A CONTINUOUS FLOW SYSTEM,
Amsterdam Univ. (Netherlands). Lab. voor Microbiologie.
L. van Liere, and L. R. Mur.
Hydrobiologia, Vol. 92, p 511-518, July, 1982. 8 Fig, 9 Ref.

Descriptors: *Groundwater movement, *Phosphorus, *Sediments, Flow, Interstitial water.

An experimental system based on a continuous flow reactor is presented in which undisturbed sediment cores can be investigated with regard to the release of phosphorus to the overlying water and the characteristics of the interstitial water. In this system the effect of simulated vertical groundwater movement was also studied. The results of three preliminary experiments are shown: undisturbed core, core in which downward migration was stimulated, and core in which upward migration was stimulated. In all experiments the amount of released phosphorus rose very rapidly to high values, due probably in part to the effects of freeze/thaw on the cores, although no measurable shift in the interstitial profile was observed during thawing. The latter two experiments showed a rapid loss of phosphorus from the system in contrast to the first experiment. This process was reflected in the phosphorus concentration of the interstitial water. Restoration in regions with downward migration of sediment water is likely to be most rapid. In other regions the hydraulic retention time may become very important. (Baker-IVI)
W85-02094

THREE-DIMENSIONAL STREAMLINES IN DUPUIT-FORCHHEIMER MODELS,
Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
O. D. L. Strack.
Water Resources Research, Vol. 20, No. 7, p 812-822, July, 1984. 14 Fig, 16 Ref, 1 Append.

Descriptors: *Streamlines, *Dupuit-Forchheimer models, *Groundwater movement, Computer models, Flow resistance, Infiltration, Permeability, Model studies.

The modeling of steady regional aquifer flow is generally done by the use of two-dimensional numerical or analytical models that are based upon a Dupuit-Forchheimer approximation. An approximate method is presented for determining streamlines in three dimensions using two-dimensional Dupuit-Forchheimer models. This approach is based upon the interpretation of the Dupuit-Forchheimer assumption that the resistance to flow in the vertical direction is neglected. This assumption does not preclude the occurrence of flow in the vertical direction; vertical components of flow are determined in an approximate fashion by requiring continuity of flow. Its accuracy appears to depend primarily upon the variation with position of the rate of infiltration through the upper and lower boundaries of the aquifer considered. The approach may be used in computer models based on either numerical or analytical techniques. It is applicable to aquifers with layers of different permeabilities and will be particularly useful in determining flow paths in systems of stacked aquifers. In many problems of practical importance, the approximate method of determining streamlines in three dimensions may make it unnecessary to resort to three-dimensional models. (Moore-IVI)
W85-02148

DOUBLE-POROSITY MODELS FOR A FISSURED GROUNDWATER RESERVOIR WITH FRACTURE SKIN,
Geological Survey, Menlo Park, CA.
A. F. Moench.
Water Resources Research, Vol. 20, No. 7, p 831-846, July, 1984. 14 Fig, 4 Tab, 45 Ref, 3 Append.

Descriptors: *Porosity, *Groundwater movement, *Geologic fractures, Model studies, Permeability

coefficient, Hydraulic head, Flow resistance, Wells.

Theories of flow to a well in a double-porosity groundwater reservoir are modified to incorporate effects of a thin layer of low-permeability material or fracture skin that may be present at fracture-block interfaces as a result of mineral deposition or alteration. The commonly used theory for flow in double-porosity formations that is based upon the assumption of pseudo-steady state block-to-fissure flow is shown to be a special case of the theory presented in this paper. The latter is based on the assumption of transient block-to-fissure flow with fracture skin. Under conditions where fracture skin has a hydraulic conductivity that is less than that of the matrix rock, it may be assumed to impede the interchange of fluid between the fissures and blocks. Resistance to flow at fracture-block interfaces tends to reduce spatial variation of hydraulic head gradients within the blocks. This provides theoretical justification for neglecting the divergence of flow in the blocks as required by the pseudo-steady state flow model. Coupled boundary value problems for flow to a well discharging at a constant rate were solved in the Laplace domain. Both slab-shaped and sphere-shaped blocks were considered, as were effects of well bore storage and well bore skin. Results obtained by numerical inversion were used to construct dimensionless-type curves that were applied to well test data, for a pumped well and for an observation dimension-less-type curves that were applied to well test data, for a pumped well and for an observation well, from the fractured volcanic rock terrane of the Nevada Test Site. (Author's abstract)
W85-02150

FLUX-AVERAGED AND VOLUME-AVERAGED CONCENTRATIONS IN CONTINUUM APPROACHES TO SOLUTE TRANSPORT,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
J. C. Parker, and M. Th. Van Genuchten.
Water Resources Research, Vol. 20, No. 7, p 866-872, July, 1984. 2 Fig, 1 Tab, 23 Ref.

Descriptors: *Solute transport, *Convection, *Dispersion, *Flux-averaged concentrations, *Volume-averaged concentrations, Mathematical equations, Boundary conditions, Porous media, Interstitial water.

Transformations between volume-averaged pore fluid concentrations and flux-averaged concentrations are presented which show that both modes of concentration obey convective-dispersive transport equations of identical mathematical form for non-reactive solutes. The pertinent boundary conditions for the two modes, however, do not transform identically. Solutions of the convection-dispersion equation for a semi-infinite system during steady flow subject to a first-type inlet boundary condition is shown to yield flux concentrations, while solutions subject to a third-type boundary condition yield volume-averaged concentrations. These solutions may be applied with reasonable impunity to finite as well as semi-infinite media if back mixing at the exit is precluded. Implications of the distinction between resident and flux concentrations to laboratory and field studies of solute transport are discussed. It is suggested that perceived limitations of the convection-dispersion model for media with large variations in pore water velocities may in certain cases be attributable to a failure to distinguish between volume-averaged and flux-averaged concentrations.
W85-02153

MOTION OF TWO COMPRESSIBLE FLUIDS WITH INTERFACE IN A POROUS RESERVOIR,
Department of Scientific and Industrial Research, Wellington (New Zealand). Applied Mathematics Div.
R. A. Wooding, and G. J. Weir.
Water Resources Research, Vol. 20, No. 7, p 873-886, July, 1984. 14 Fig, 2 Tab, 22 Ref.

Descriptors: *Groundwater movement, *Porous media, Groundwater reservoirs, Model studies, Pressure, Gas-water interface, Leaky aquifers, Porosity, Permeability, Mathematical equations.

This paper describes the development of a physical model of a reservoir involving two compressible fluids, typically gas over water. The reservoir is assumed to be of constant thickness, but its height varies with position, leading to an undulating topography. Withdrawal of the upper fluid begins and proceeds at a constant rate. Topics of interest are the distribution of fluxes throughout the reservoir, the pressure field as a function of time and space, and the movement of the interface between the fluids. The problem is formulated using a version of the two-fluid layer concept. One of the space variables is eliminated by vertical integration, assuming that the fluid velocity vector is almost parallel to the upper and lower confining boundaries (Boussinesq reservoir). The resulting equation of motion for the horizontal components of the flow resembles that for a horizontal reservoir, but terms involving the gradient of the undulating reservoir modify the vertical pressure gradient. The problem is solved in two space dimensions and time. The difficulty presented by intersections of the fluid-fluid interface with one or other of the confining boundaries is resolved by introducing a mathematical continuation of the fluids and their interface through and past the boundary. This is particularly appropriate for 'leaky' aquifers; in the case of impermeable boundaries, a concern of the present paper, approximate solutions may be obtained by assuming a virtual porosity and permeability which are extremely small. The method resembles that of Wilson and Sa da Costa (Water Resour. Res., 18, 1069-1080, 1982) Some useful results have been obtained for Boussinesq reservoirs of fairly arbitrary geometry. Approximate numerical solutions are presented for two-dimesional flow in a rectangular reservoir, the outer part of which is completely submerged, and for axisymmetric and three-dimensional flows in a circular quadrant. A constriction upon the gas flow due to a 'dip' in the reservoir is found to produce enhanced horizontal water flow due to the increase in horizontal pressure gradient. Downstream of the dip the interface develops an elevation, while a depression appears upstream. The establishment of stable flow of gas through a 'neck' between two gas reservoirs is demonstrated, and it is proposed that a similar type of flow can be developed as a result of gas fingering through an initially submerged neck. Further applications of the technique could be to reservoirs containing steam over water (geothermal) or to the coastal saltwater intrusion problem, but these are not considered in the present paper. (Author's abstract)
W85-02154

GROUNDWATER RESPONSE UNDER AN ELECTRONUCLEAR PLANT TO A RIVER FLOOD WAVE ANALYZED BY A NONLINEAR FINITE ELEMENT MODEL,
Padua Univ. (Italy). Inst. of Applied Mathematics.
G. Gambolati, F. Toffolo, and F. Uliana.
Water Resources Research, Vol. 20, No. 7, p 903-913, July, 1984. 12 Fig, 1 Tab, 36 Ref.

Descriptors: *Groundwater level, *Flood waves, *Mathematical models, *Trino Vercellese, *Italy Nuclear powerplants, Water table, Finite element models, Permeability coefficient, Specific yield.

In the foundation design of electronuclear plants, conservative stability criteria with respect to earthquakes are usually assumed, where the maximum water table level beneath the nuclear reactor in response to possible flood waves occurring in the nearby river is taken to coincide with the ground surface elevation. This approach may dictate heavier structural constraints; hence additional costs that could be minimized if a realistic prediction of the aquifer behavior and of the actual largest pressure head below the plant is provided by appropriate mathematical tools. A nonlinear finite element model based on the Dupuit-Boussinesq equation of flow in an unconfined aquifer has been developed and applied to simulate the water table fluctuation under the electronuclear plant of the test site of Trino Vercellese (nothwestern Italy) in response to the flood event that occurred in the Po River from March 30 to April 4, 1981. The nonlinearity has been overcome by the aid of an efficient iterative linearization technique wherein the model equations are solved by symbolic factorization, numerical factorization, and backward-forward subsitution after an optimal preliminary recording. The model was run for uniform values of aquifer permeability and specific yield within the typical range evidenced for the Trino sands by the early data in our possession. The results show that the maximum water level elevation below the reactor is almost 3 m lower than the corresponding river flood peak even in the most unfavorable conditions, i.e., with the hydraulic conductivity in the upper range, and is rather insensitive to the specific yield values within the plausible interval. The model allowed for an easy evaluation of the effectiveness of the impermeable protection walls and of a possible secondary aquifer recharger from a minor channel. The modeling approach for the analysis of the water behavior appears to be a very promising tool to help in the structural design of future electronuclear plants. (Author's abstract)
W85-02157

PRESSURE TRANSIENT ANALYSIS FOR TWO-PHASE GEOTHERMAL WELLS: SOME NUMERICAL RESULTS,
S-Cubed, La Jolla, CA.
S. K. Garg, and J. W. Pritchett.
Water Resources Research, Vol. 20, No. 7, p 963-970, July, 1984. 26 Fig, 6 Tab, 12 Ref.

Descriptors: *Geothermal wells, *Pressure transient analysis, Geothermal reservoirs, Simulation, Mathematical models, Two-phase reservoirs, Flashing, Permeability, Kinematic mobility.

A numerical geothermal reservoir simulator is used in a series of calculations to help devise interpretation techniques for analyzing pressure transient data from two phase geothermal reservoirs. The investigations include (1) the drawdown/buildup behavior of initially two-phase (liquid water/stream) reservoirs, (2) the drawdown/buildup response of initially single-phase reservoirs which undergo flashing as a result of fluid production, and (3) the effects of cold water injection into hot two-phase reservoirs. Production (drawdown/buildup) data from two-phase (either initially or due to production-induced boiling) reservoirs may be analyzed in the usual manner to yield kinematic mobility; buildup data from reservoirs which undergo flashing on production also offer the possibility of determining absolute formation permeability. Injection data can be interpreted in a straightforward manner to yield absolute formation permeability; the corresponding falloff data appear, however, to be of little value. (Author's abstract)
W85-02163

PARAMETER IDENTIFICATION OF GROUNDWATER AQUIFER MODELS: A GENERALIZED LEAST SQUARES APPROACH,
California Univ., Los Angeles. School of Engineering and Applied Science.
J. Sadeghipour, and W. W.-G. Yeh.
Water Resources Research, Vol. 20, No. 7, p 971-979, July, 1984. 8 Fig, 4 Tab, 18 Ref. NSF grant CEE 81-13500.

Descriptors: *Transmissivity, *Least squares method, *Aquifers, Mathematical models, Groundwater, Hydraulic head, Parameter identification.

This paper concerns the methods of estimating aquifer transmissivities on the basis of unsteady state hydraulic head data. Traditionally, the criterion of minimizing the sum of the squares of errors has been used to match the observed data with the model response. The data used for optimization usually contain noise that is not necessarily uncorrelated. It is well understood that the results of identification methods are very sensitive to measurement errors in data. In this study, the ordinary least squares (OLS) technique is carried out along with a generalized least squares (GLS) technique specifically designed to reduce the effect of correlated errors. The trace of the covariance matrix is used as a measure of overall accuracy and reliability of the estimated parameters. The effectiveness

of the OSL and GLS techniques in dealing with noisy data is demonstrated by using a hypothetical example. The results of numerical experiments suggest that GLS offers a promising approach in efficiently improving the reliability of the estimated parameters. (Author's abstract)
W85-02164

DARCY'S FLOW WITH VARIABLE PERMEABILITY: A BOUNDARY INTEGRAL SOLUTION,
Columbia Univ., New York. Dept. of Civil Engineering.
A. H.-D. Cheng.
Water Resources Research, Vol. 20, No. 7, p 980-984, July, 1984. 8 Fig, 1 Tab, 11 Ref. NSF grant CEE-8307069.

Descriptors: *Permeability, *Mathematical equations, *Darcy's law, *Groundwater movement, Boundaries.

A boundary integral equation method (BIEM) for Darcy's flow with spatially varied permeability is developed. The numerical solution is efficient if a closed-form Green's function is available. The Green's functions are derived for a few permeability functions in one and two dimensions. The permeabilities can be used for simple fit of field permeability data. (Baker-IVI)
W85-02165

TRAVEL TIMES FROM BURIED AND SURFACE INFILTRATION POINT SOURCES,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Environmental Mechanics.
For primary bibliographic entry see Field 2G.
W85-02167

APPLICATION OF THE GEOSTATISTICAL APPROACH TO THE INVERSE PROBLEM IN TWO-DIMENSIONAL GROUNDWATER MODELING,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
R. J. Hoeksema, and P. K. Kitanidis.
Water Resources Research, Vol. 20, No. 7, p 1003-1020, July, 1984. 21 Fig, 4 Tab, 20 Ref, 2 Append. Iowa Water Resources Research Institute project CT 381702, NSF grant CME-8106577.

Descriptors: *Transmissivity, *Groundwater, *Geostatistical approach, *Jordan aquifer, *Iowa, Mathematical models, Hydraulic head, Covariance.

A methodology is presented for the estimation of transmissivity from head and transmissivity measurements in the two-dimensional steady flow case following the geostatistical approach to inverse modeling. The field of the logarithm of transmissivity (log-transmissivity) is represented as a zero-order intrinsic random field; its spatial structure is described in this application through a two-term covariance function that is linear in the parameter 01 and 02. Linearization of the discretized flow equations allows the construction of the joint covariance matrix of the head and log transmissivity measurements as a linear function of 01 and 02. The coefficient matrices are calculated numerically in a noniterative fashion. Maximum likelihood estimation is employed to estimate 01 and 02 as well as additional parameters from measurements. Linear estimation theory (cokriging) then yields point or block-averaged estimates of transmissivity. The application of the methodology gives good estimates of transmissivities. When the transmissivities are used in a numerical model they reproduce the head measurements quite well. The developed methodology was applied for the estimation of transmissivities of the Jordon aquifer in Iowa. This case study illustrated that the geostatistical approach can be a useful tool in the iterative process of model development. Model validation serves to diagnose possible conflicts between modeling assumptions and available data and to suggest ways in which these conflicts can be resolved. In the case of the Jordan aquifer, accounting for leakage into the aquifer and removal of two outliers appeared to improve the consistency among modeling assumptions and measurements. (Moore-IVI)
W85-02169

CONTAMINANT TRANSPORT IN FRACTURED POROUS MEDIA: ANALYTICAL SOLUTION FOR A TWO-MEMBER DECAY CHAIN IN A SINGLE FRACTURE,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 5B.
W85-02170

2G. Water In Soils

USE OF FIXED-BED ADSORBER MODELS TO PREDICT THE FLUXES OF TOXIC SUBSTANCES IN GROUNDWATERS AND SOIL ENVIRONMENTS,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W85-01793

NEW MATERIALS IN PIPE NETWORKS - SPECIAL CONSIDERATION OF INTERNAL COATINGS,
Zurich Water Supply (Switzerland).
A. Naf.
Aqua, No. 5, p 221-224, 1983. 14 Fig, 1 Tab.

Descriptors: *Corrosion, *Pipelines, *Linings, Pipes, Water conveyance, Water distribution, Cement, Mortar, Linings.

Reliable corrosion protection of metallic pipelines is an important factor in determining the quality of ground installed facilities. Besides the choice of material and insulation, attention must be given to the installation which must be performed in a clean and expert manner. The lining of water pipelines with bitumen is rarely used today. Theoretical perceptions show that the carcinogenic compounds contained in the tar are transferred to the water. Cement mortar lining is not completely impermeable. Water penetrates through the mortar to the pipe wall. The formation of ferric hydroxide, however, results in an essentially increased bondage. As an alternative solution to the cement mortar lining a Swiss Pipeline product using a synthetic material lining has been developed. Results of tests of pipe strength and resistance to corrosion are discussed along with the manufacture of fittings and accessories and tension-proof connections. (Baker-IVI)
W85-01997

MICROWAVE MEASUREMENTS OF MOISTURE DISTRIBUTIONS IN THE UPPER SOIL PROFILE,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
A. M. Sadeghi, G. D. Hancock, W. P. Waite, H. D. Scott, and J. A. Rand.
Water Resources Research, Vol. 20. No. 7, p 927-934, July, 1984. 10 Fig, 3 Tab, 23 Ref. NASA grant NAG-5-20.

Descriptors: *Soil water, *Microwaves, *Remote sensing, Reflectivity, Tillage, Evaporation, Drying, Soil properties.

Laboratory and field experiments were conducted to investigate the ability of microwave remote sensing systems to detect the moisture status of a silt loam soil exhibiting abrupt changes in moisture content near the surface. Laboratory soil profiles were prepared with a discontinuous moisture boundary in the subsurface. Reflectivity measurements of these profiles were made with a bistatic reflectometer operating over the frequency ranges of 1-2 and 4-8 GHz (wavelength ranges of 30-15 and 7.5-3.75 cm, respectively). These measurements exhibited a well-developed coherent interference pattern in good agreement with a simple two-layer reflectivity model. Field measurements of bare soil surfaces were conducted for initially saturated profiles and continued for extended periods of drying. During drying, coherent interference patterns similar to those observed in the laboratory were detected. These appear to be due to steep moisture gradients occurring between drying layers near the surface. The field results were modeled by a five-segment linear moisture profile with one or two steep segments and a multilayer reflectivity program. Agreement between model and field response over the frequency range was used to estimate the depth of drying layers within the soil. These depths were monitored over the second and third drying cycles. Formation of the drying layers under field conditions appears to be influenced by drying time, tillage, and evaporative demand. In any case, it appears that the coherent effects caused by nonuniform moisture profiles may substantially affect the reflectivity of even rough soil surfaces. (Author's abstract)
W85-02160

TRAVEL TIMES FROM BURIED AND SURFACE INFILTRATION POINT SOURCES,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Environmental Mechanics.
J. R. Philip.
Water Resources Research, Vol. 20, No. 7, p 990-994, July, 1984. 3 Fig, 13 Ref.

Descriptors: *Solute transport, *Mathematical equations, *Infiltration, Water pollution sources, Leaching, Soil water, Convection, Diffusion.

A primary element in the analysis of solute transport and leaching during steady saturated and unsaturated two- and three-dimensional soil water flows is the time of travel of marked water particles from their source to all downstream points of the flow field. Exact travel time solutions for flows of physical interest are clearly of significance. The exact solutions are presented for travel times for three-dimensional steady infiltration into a homogeneous soil from buried and surface point sources. While the study was developed specifically in terms of the quasi-linear analysis of water movement in unsaturated soils, it will be understood that the mathematical results apply to any steady convection-diffusion process described by an equation of a specified form, together with appropriate boundary conditions. In this sense, the exact solutions for travel times are presented from continuous point sources for all linear convection-diffusion processes in the appropriate infinite and semi-infinite regions. The results are presented graphically. In the soil water context a limitation is that travel velocities are based on a mean volumetric moisture content. (Baker-IVI)
W85-02167

2H. Lakes

WATER TEMPERATURE AND TURBIDITY IN GLACIALLY FED LAKE TEKAPO,
Department of Scientific and Industrial Research, Wellington (New Zealand). Oceanographic Inst.
J. Irwin, and R. A. Pickrill.
New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 2, p 189-200, 1982. 5 Fig, 16 Ref.

Descriptors: *Lake Tekapo, *New Zealand, *Water temperature, *Turbidity, *Glacial lakes, Glacial streams, Godley River, Thermal stratification, Coriolis force, Isotherms.

Inflow into Lake Tekapo (New Zealand) is dominated by the glacially-fed headwater Godley River. Measurements of water temperature and transmissivity at periods of seasonal maxima and minima provide data on dispersion of river water entering the lake. During spring, lake waters warming from isothermal winter conditions receive turbid cold meltwater which interflows or underflows downslope to the deepest basin to pond against the rising lake floor. Waters stratify weakly in summer, and turbid inflowing water interflows. In winter, near isothermal lake water receives cold clear water underflowing to the deepest basin. In all seasons inflowing water is deflected towards the eastern side of the lake by Coriolis force. Diurnal changes in inflow across the Godley delta in spring are complex, with interflow and overflow

influenced by heating of waters flowing over wide, braided river channels. In winter, underflows are strongest in early morning when inflows are coldest, and they weaken through the day as river waters warm. (Author's abstract)
W85-01637

PREDOMINANT HEADWATER INFLOW AND ITS CONTROL OF LAKE-RIVER INTERACTIONS IN LAKE WAKATIPU,
Department of Scientific and Industrial Research, Wellington (New Zealand). Oceanographic Inst.
R. A. Pickrill, and J. Irwin.
New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 2, p 201-213, 1982. 5 Fig, 23 Ref.

Descriptors: *Lake Wakatipu, *New Zealand, *Inflow, Temperature, Suspended solids, Particulate matter, Water temperature, Under flow.

Temperature and suspended particulate matter concentrations were used to identify lake-river interactions in Lake Wakatipu (New Zealand). Results from sampling at seasonal maxima and minima of water temperature and inflow, in conjunction with density estimates, suggest that both annual and diurnal cycles from inflow from the predominant headwaters are generated. From mid autumn to mid spring, underflows predominate; in summer, river water may warm sufficiently to allow inflowing water to interflow or overflow. In summer the large diurnal temperature range in the rivers sets up a diurnal cycle of inflows, with underflow in the early morning, progressing through to interflows and finally overflows again at night. In winter, when river temperatures remain low throughout the day, inflowing water underflows continuously. Floods normally enter as turbid underflows, disrupting the diurnal summer cycle and strengthening the underflows of winter. Flood underflows reach speeds of over 20 cm/s and carry particulate material over 60 km downslope into the deepest basin. (Author's abstract)
W85-01638

SEASONAL MEROMIXIS IN THREE HYPERSALINE LAKES ON ROTTNEST ISLAND, WESTERN AUSTRALIA,
Western Australia Univ., Nederlands. Dept. of Zoology.
S. E. Bunn, and D. H. D. Edward.
Australian Journal of Marine and Freshwater Research, Vol. 35, No. 2, p 261-265, 1984. 2 Fig, 1 Tab, 13 Ref.

Descriptors: *Western Australia, *Australia, *Rottnest Island, *Meromictic lakes, *Saline lakes, Stratification, Water temperature, Salinity.

On Rottnest Island, approximately 19 km west of Fremantle, Western Australia, there are six permanent hypersaline lakes; three of the lakes become meromictic 'hot lakes' during winter and spring. These are the first such lakes recorded in Australia. Monthly temperature profiles were taken from June 1980 to January 1981 and from April to December 1982 in Serpentine Lake. Profiles were also taken in Government House, Herschell, and Bagdad Lakes. An important factor contributing to the transient stratification is a surface input of fresh water from seepages around the lakes, which overlays the existing hypersaline layer. Heat penetrates to the monimolimnion of these clear-water lakes and is trapped by the insulating effect of the overlying less-saline water. The disappearance of the stratification at the onset of summer is thought to be due to reduced freshwater input and evaporation of the less-saline mixolimnion. Stratification was never observed in either of the two shallow salt lakes, Bagdad and Garden; since these lakes also receive freshwater from seepages it is likely that the shallow conditions permit complete mixing throughout the year. (Collier-IVI)
W85-01645

DECOMPOSITION OF WILD RICE (ZIZANIA AQUATICA) STRAW IN TWO NATURAL LAKES OF NORTHWESTERN ONTARIO,
Ontario Ministry of Natural Resources, Kenora. Nortwestern Region.
P. Sain.
Canadian Journal of Botany, Vol. 62, No. 7, p 1352-1356, July, 1984. 5 Fig, 1 Tab, 25 Ref.

Descriptors: *Ontario, *Rice, *Decomposition, *West Bay, *Lulu Lake, *Nutrients, Nitrogen, Phosphorus, Potassium, Calcium, Sulfur, Magnesium, Carbon.

Decomposition of wild rice (Zizania aquatica L.) straw was studied by placing 20 g of air-dried straw into 25 X 15 cm size nylon bags. Each set of five straw bags was covered in a fine aluminum screen to avoid damage from aquatic animals. The screens were placed on October 17, 1979, in West Bay representing a river system and in Lulu Lake, a typical shallow wild rice lake. After 350 days the total decomposition by weight of straw was 94 and 72% in West Bay and Lulu Lake, respectively. Release of nutrients from the straw was studied by calculating the percent loss of nutrients in each sampling period. A rapid release of nutrients was observed during the first 3 wk followed by a slow release of nutrients thereafter. Total amounts of nutrients released after 350 days were about 98% potassium, 82% calcium, 81% phosphorus, 79% sulfur, 72% magnesium, and 57% nitrogen. The amount of nitrogen released and the carbon:nitrogen ratio of straw at the jointing stage of wild rice suggest that a major portion of the total nitrogen remains tied up in straw and may not become available for the next wild rice crop. (Author's abstract)
W85-01647

VEGETATION AND WATER CHEMISTRY OF FOUR OLIGOTROPHIC BASIN MIRES IN NORTHWESTERN ONTARIO,
Alberta Univ., Edmonton. Dept. of Botany.
D. H. Vitt, and S. Bayley.
Canadian Journal of Botany, Vol. 62, No. 7, p 1485-1500, July, 1984. 28 Fig, 5 Tab, 45 Ref.

Descriptors: *Ontario, *Vegetable crops, *Oligotrophic lakes, *Peat bogs, *Mires, Precambrian Shield, Calcium, Conductivity, Hydrogen ion concentration, Mosses, Magnesium, Sulfates, Nitrates, Alkalinity.

Four small oligotrophic basin mires on the Precambrian Shield were quantitatively analyzed for vegetation patterns and surface water and groundwater chemistry. Mean concentrations of ions in the surface waters of all vegetation stands indicate these mires to be characterized by low calcium content (0.6-1.9 mg Ca/L), low corrected conductivity (12-31 micro mho/cm (1 mho = 1 S)), and relatively high pH (4.0-5.7). Mire 224 is dominated by Chamaedaphne calyculata, Scheuchzeria palustris, and Carex oligosperma. The surface water mean determinations are Ca, 1.10 +/- 0.51 mg/L; Mg, 0.57 +/- 0.2 mg/L; corrected conductivity, 16.7 +/- 4.2 micro mho/cm; and pH 4.37. Abundance patterns of the dominant Carex species can be correlated with pH of the surface water of the mire. Mire 239 is characterized by Smilacina trifolia, Ledum groenlandicum, and Carex trisperma. The mean surface water determinations are Ca, 1.53 +/- 0.36 mg/L; Mg, 0.59 mg/L; corrected conductivity, 21.2 +/- 2.0 micro mho/cm; and pH 4.0. Significant differences in pH, Ca, and Mg occur between the interior and edge portions of this bog. Water chemistry from portions burned in 1974 showed no differences from unburned portions. The vegetation of mire 661 contains a sequence of communities positioned relative to the inflow streams, with a Myrica gale - Alnus rugosa community followed by a zone dominated by Picea mariana then a Larix laricina zone and then by an open Sphagnum papillosum - Menyanthes trifoliata lake edge zone. More ombrotrophic areas are dominated by Sphagnum fuscum. Ca, Mg, and Fe concentrations, pH, and corrected conductivity were reduced through this sequence. Comparison of weekly samples of water entering and leaving this mire in 1981 showed a reduction of Ca, Mg, SO4, NO3 N, alkalinity, and pH. (Author's abstract)
W85-01648

VERTICAL TEMPERATURE DISTRIBUTION IN LAKES,
National Bureau of Standards (NEL), Boulder, CO. Center for Chemical Engineering.
R. D. Noble, N. J. Kemp, and R. G. Buschman.
Journal of Environmental Systems, Vol. 14, No. 1, p 63-75, 1984-85. 2 Fig, 15 Ref, 1 Append.

Descriptors: *Water temperature, *Vertical distribution, *Lakes, *Solar radiation, Heat transfer, Model studies, Air-water interface, Thermal stratification.

Analytical expressions for the vertical temperature distribution in large lakes and other large water bodies are not available for the general case. This is due in large measure to two problems: there are non-linearities in the heat exchange term at the air-water interface and the actual absorbed radiation at the air-water interface has been difficult to express analytically. Analytical solutions were developed for the vertical temperature distribution in lakes. The solutions are good for large water bodies where inflows and outflows are negligible. The solution is based on a linearization of the surface heat exchange term. Solutions were developed for both zero-order and first order linearizations. An analytical expression was used to describe the actual daily absorbed radiation at the air-water interface. Since the model can account for variations in incoming solar radiation over time, the model could be very useful for estimating the vertical temperature distribution over extended periods. It would also be useful as a check on numerical solutions and a check on limiting cases of surface heat exchange. The model contains no adjustable parameters. Based on comparisons with experimental data, the model predictions become better as one approaches the end of the averaging period for the surface heat loss values. (Collier-IVI)
W85-01651

INFLUENCE OF PHYSICO-CHEMICAL FACTORS ON THE COLIFORM BACTERIA IN A CLOSED-LAKE WATER SYSTEM,
Jawaharlal Nehru Univ., New Delhi (India). Microbiological Lab.
U. S. Bagde, A. M. Khan, and A. K. Varma.
International Journal of Environmental Studies, Vol. 18, No. 3/4, p 237-241, 1982. 7 Fig, 16 Ref.

Descriptors: *Physicochemical properties, *Coliforms, *New Delhi, *India, Nutrient requirements, Bacteria, Nitrogen, Phosphates, Hydrogen ion concentration, Conductivity, Water temperature, Hardness, Sulfates, Ammonia, Nitrates, Nitrites.

Correlation of physical and chemical factors with biological factors has not been included in most research on heterotrophic pathogenic coliform bacteria. During the hot and humid period of May to August, epidemic diseases caused by coliform organisms are commonly reported in northern India. The coliform group of micro-organisms responsible for causing pollution in drinking waters was examined in a lake on the East-North of New Campus of Jawaharlal Nehru University, New Delhi. Bacterial counts (MPN) were correlated with certain physical and chemical factors, viz. electrical conductivity, pH, temperature, Ca-Mg hardness, inorganic nitrogen substances, inorganic sulfate and phosphate contents of the water. The coliform counts (MPN) varied with seasonal variations and changes in the properties of the water bodies. An inverse correlation of bacterial counts was noted with the dissolved inorganic nitrogenous compounds like ammonia, nitrite and nitrate. Similar observations were made when compared with dissolved salts of phosphate and sulfate. (Collier-IVI)
W85-01672

OXYGEN DEPLETION IN CENTRAL AND EASTERN LAKE ERIE: RELATIONSHIP WITH BACTERIA, CHLOROPHYLL, POC, AND MORPHOMETRY,
National Water Research Inst., Burlington (Ontario).
M. N. Charlton, and S. S. Rao.

Journal of Great Lakes Research, Vol. 9, No. 1, p 3-8, 1983. 2 Fig, 3 Tab, 16 Ref.

Descriptors: *Lake Erie, *Oxygen depletion, *Bacteria, *Chlorophyll, *Organic carbon, Lake morphology, Hypolimnion, Particulates, Metabolism, Lake sediments.

Hypolimnion oxygen depletion in central and eastern Lake Erie was related to bacteria, particulate organic carbon, and chlorophyll concentrations during 1979. The central basin had the higher oxygen depletion rate and this was associated with more microbiota and particulate organic carbon. After compensation for temperature differences, the rate of oxygen depletion per unit bacteria, chlorophyll, and particulate organic carbon was found to be similar in each basin. These observations are consistent with hypothesis that lake morphometry affects oxygen depletion through the control of hypolimnion particle concentrations. The implication that most of the hypolimnion oxygen metabolism occurs in the water column means that the role of sediments as a site of oxygen consumption should be reassessed. (Author's abstract)
W85-01752

ROLE OF SEDIMENTS IN THE NITROGEN BUDGET OF LOWER GREEN BAY, LAKE MICHIGAN,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5B.
W85-01754

ASSOCIATION BETWEEN NET BASIN SUPPLIES TO LAKE SUPERIOR AND SUPPLIES TO THE LOWER GREAT LAKES,
Wisconsin Univ.-Madison. Dept. of Geography.
W. A. R. Brinkmann.
Journal of Great Lakes Research, Vol. 9, No. 1, p 32-39, 1983. 5 Fig, 4 Tab, 13 Ref.

Descriptors: *Great Lakes, *Lake Superior, *Water level, *Hydrologic budget, Eigenvector analysis, Precipitation, Water supply.

Eigenvector analysis was carried out on monthly net basin supplies for the Great Lakes for the period of 1900-1973. Net basin supply anomalies for Lake Superior are to a large degree uncorrelated with those for the lower three lakes. There is a certain degree of opposition in the sign of the anomalies, particularly in the moderate range of net basin supplies. Extreme magnitudes (exceeding one standard deviation for at least part of the system) are almost always of the same sign. This suggests that the use of Lake Superior as a storage reservoir, in the absence of reliable long range weather predictions, is of some benefit during periods of moderate net basin supplies only, because periods of prolonged severe events tend to be basin-wide. Variations in the time series of the eigenvector coefficients suggest that, in general, supplies tended to be above average for the low lakes until about the 1930s and again since the mid 1960s, and that supplies tended to be above average for Lake Superior during the 1940s and 1950s. These times of change are in agreement with the timing of shifts in large scale circulation patterns for the Northern Hemisphere as well as for eastern North America and with the times of change in temperature and precipitation patterns over the Great Lakes region. (Baker-IVI)
W85-01755

INFLUENCE OF THE ST. MARYS RIVER PLUME ON NORTHERN LAKE HURON PHYTOPLANKTON ASSEMBLAGES,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
R. G. Kreis, Jr., T. B. Ladewski, and E. F. Stoermer.
Journal of Great Lakes Research, Vol. 9, No. 1, p 40-51, 1983. 6 Fig, 2 Tab, 34 Ref.

Descriptors: *St. Marys River, *Lake Huron, *Phytoplankton, Diatoms, Entrainment, Plumes, Water circulation, Suspended sediments, Sinking, Chlorophyll a, Benthic flora.

Analysis of phytoplankton samples from the Straits of Mackinac region yielded high species diversity and species richness values at the outfall of the St. Marys River due to entrained benthic diatoms. Epilithic, psammonic, epipelic, and epiphytic diatoms originating in the St. Marys River and Detour Passage area were removed from their primary habitats and transported into northern Lake Huron. Southward movement of the St. Marys River plume, as determined from suspended benthic diatom distribution and abundance, was strongly indicated for 3 km. Moderate influence of the plume was noted at 6 km and weaker association with the plume was detected for as far as 32 km. Apparently, loss of suspended riverine species from the upper water column in this area was primarily due to sinking. Sinking, calculated from residence times based on river discharge data, was estimated to range between 0.76 and 5.99 m/day. Total phytoplankton abundance and chlorophyll a values were lower near the rivermouth. Conversely, C-14 uptake was significantly greater near the river. Benthic populations comprised as much as 40% of the assemblage and an additional amount of dead and fragmentary diatoms was also observed. Viable benthic diatoms may contribute as much as 25% of the algal assemblage on a cell volume basis. Upon death and decomposition, they may constitute an important source of carbon and nutrients in the immediate vicinity. (Author's abstract)
W85-01756

SPECTRAL ATTENUATION AND IRRADIANCE IN THE LAURENTIAN GREAT LAKES,
National Water Research Inst., Burlington (Ontario). Aquatic Physics and Systems Div.
J. H. Jerome, R. P. Bukata, and J. E. Bruton.
Journal of Great Lakes Research, Vol. 9, No. 1, p 60-68, 1983. 7 Fig, 1 Tab, 9 Ref.

Descriptors: *Great Lakes, *Optical properties, *Spectral attenuation, *Irradiance, Lake Superior, Lake Huron, Lake Erie, Lake Ontario, Productivity.

The optical characteristics of the Laurentian Great Lakes range from the clearest waters of the upper lakes (Lake Superior, Lake Huron/Georgian Bay) to the turbid waters of the lower lakes (Lake Erie and Lake Ontario). It is these optical characteristics that determine the quantity and quality of radiation that is available for photosynthesis at a giver depth. Optical data collected between 1973 and 1979 are utilized to study spectral attenuation and irradiance in the midlake waters of the four Great Lakes. Particular attentuation is given to the photosynthetic available radiation (PAR), its incident spectral distribution, its spectral attenuation, and its qualitative change with depth. Curves are shown illustrating these spectral properties as well as the relationships between PAR and the photosynthetic usable radiation (PUR) for each of the lakes. These curves, along with the included mathematical relationships, enable quantitative estimates to be obtained of incident PAR, subsurface PAR, and subsurface PUR, and qualitative information to be obtained on subsurface irradiance levels for the Laurentian Great Lakes. Lake Superior and Lake Huron/Georgian Bay, in general, display similar and comparable optical characteristics, as do Lakes Erie and Ontario. The optical characteristics of the upper Great Lakes, however, are quite distinct form those of the lower Great Lakes. These similarities and differences between the Laurentian Great Lakes are a direct consequence of the levels of productivity, with the upper Great Lakes being characterized by low productivity and the lower Great Lakes being characterized by higher productivity. (Moore-IVI)
W85-01757

PREDICTING VARIABILITY IN A LAKE ONTARIO PHOSPHOROUS MODEL,
Michigan State Univ., East Lansing. Dept. of Resource Development.
R. H. Montgomery, V. D. Lee, and K. H. Reckhow.
Journal of Great Lakes Research, Vol. 9, No. 1, p 74-82, 1983. 5 Fig, 2 Tab, 25 Ref. NOAA grant 03-78-B01-109.

Descriptors: *Lake Ontario, *Phosphorus, *Model studies, Variability, Prediction, Error analysis, Monte Carlo method, Uncertainty.

The prediction of a model always has a degree of uncertainty. Because the level of uncertainty is inversely related to the value of information contained in the prediction, there is a need to quantify the uncertainty. One approach to estimate prediction uncertainty is first-order error analysis. In this method, the error in a characteristic (variable or parameter) is defined by its first nonzero moment (the variance). Errors are propagated through the model using first-order terms in the Taylor series, and the variances are then combined to yield the total prediction uncertainty. An alternative approach to model prediction error analysis is Monte Carlo simulation. In this technique, probability density functions are assigned to each characteristic (variable or parameter), reflecting the uncertainty in that characteristic. Then, values are randomly selected from the distribution for each term and inserted into the model, to calculate a prediction. Repeating this process a number of times produces a distribution of predicted values, which reflects the combined uncertainties. These two approaches (first-order error analysis and Monte Carlo simulation) are applied to Lake Ontario data using a steady state mass balance phosphorus model. Comparisons are made which suggest guidelines for the use of each. (Author's abstract)
W85-01758

NET ATMOSPHERIC INPUTS OF PCBS TO THE ICE COVER ON LAKE HURON,
De Paul Univ., Chicago, IL.
For primary bibliographic entry see Field 5B.
W85-01759

SATELLITE-TRACKED CURRENT DRIFTERS IN LAKE MICHIGAN,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 7B.
W85-01760

RELEASE OF SEDIMENT-PHOSPHORUS AND THE INFLUENCE OF ALGAL GROWTH ON THIS PROCESS,
Amsterdam Univ. (Netherlands). Lab. voor Microbiologie.
L. Van Liere, J. Peters, A. Montijn, and L. R. Mur.
Hydrobiological Bulletin, Vol. 26, No. 2-3, p 191-200, December, 1982. 5 Fig, 3 Tab, 22 Ref.

Descriptors: *Phosphorus, *Lakes, *Netherlands, *Algal growth, *Sediments, Polders, Eutrophication, Lake sediments.

A Continuous Phosphorus Release Reactor was used to measure the rate of phosphorus release from undisturbed sediment cores taken from several lakes and polders in the province of North-Holland. Findings from various lakes and polder ditches were compared with each other. Peaty lakes exchanged their particulate phosphorus rapidly with the overlying water as compared with other sediment types. This makes them suitable for phosphorus load reduction measures. There was found to be no simple direct relation between chemically extracted phosphorus fractions and the phosphorus released during the experiment. Algal growth in the overlying water stimulated the release of phosphorus. (Baker-IVI)
W85-01761

WIND INDUCED DIFFUSION IN A SHALLOW LAKE, A CASE STUDY,
Agricultural Univ., Wageningen (Netherlands). Dept. of Hydraulics and Catchment Hydrology.
J. D. Leenen.
Hydrobiological Bulletin, Vol. 16, No. 2-3, p 231-240, December, 1982. 5 Fig, 6 Ref.

Descriptors: *Shallow water, *Wind, *Diffusion, Lakes, Limnology, Mixing, Mathematical equations, Tracers.

The longitudinal mixing process in a shallow lake under the influence of wind has been studied. This process may be described with the classical convection-diffusion equation. A time scale for vertical mixing of about 6 hours was found, which is small compared to the time scale for horizontal mixing of several weeks. This is the reason that vertical mixing is negligible compared to the horizontal transport. A formula is given for estimating the longitudinal diffusion coefficient. The formula shows more differentiation than a previously developed empirical formula. Using a numerical model to describe the transport of chloride (a naturaly available tracer in this lake) the diffusion coefficient has been calibrated. Results agree favorably with the dimensional estimate and the above mentioned empirical formula. The hypothesis is stated that the macrocirculation pattern depends on the wind direction, and that the length-scale in the horizontal, wind induced diffusion process should be associated with the size of the macro-eddies and not with the size of the lake. (Baker-IVI)
W85-01763

LIMNOLOGY IN RESERVOIRS ON THE COLORADO RIVER,
Nevada Univ., Las Vegas. Lake Mead Limnological Research Center.
L. J. Paulson, and J. R. Baker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-190164, Price codes: A13 in paper copy, A01 in microfiche. Technical Report No. 11, September 1983. 269 p, 52 Fig, 3 Tab, 65 Ref, 1 Append. Project No. OWRT B-121-NEV(1), Contract/Grant No. 14-34-0001-1243.

Descriptors: Water quality management, Water quality, *Limnology, *Nitrogen, *Phosphorus, *Chlorophyll, *Productivity, *Nutrients, *Colorado River, Lake Powell, Lake Mead, Lake Mohave, Lake Havasu, Nevada, Arizona, Utah, California.

The most prevalent limnological characteristic of the Colorado River reservoirs during 1981 and 1982 was the low phosphorus concentrations that existed in most of the systems. A large percentage of the phosphorus inputs to the reservoirs from the tributaries and main stem was bound to suspended sediments. This was especially evident in Lake Powell where over 90% of the total and biologically available phosphorus inputs were sedimented (retained) in the reservoir. Total nitrogen concentration in the reservoirs decreased downstream from the headwaters of Lake Powell. This decrease was caused by nitrogen retention in each reservoir and by the lack of significant nitrogen inputs from downstream tributaries. The reservoirs were all phosphorus limited on the basis of area-weighted, annual average total nitrogen/total phosphorus (TN/TP) ratios. The ratio does decrease downstream reflecting the slight increase in phosphorus and decrease in nitrogen; however, the average annual TN/TP ratios never approached levels where nitrogen would be considered limiting.
W85-01812

HYDROLOGY OF LAKE PADGETT, SAXON LAKE, AND ADJACENT AREA, PASCO COUNTY, FLORIDA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-01826

TROPHIC ECOLOGY OF FISH REARING PONDS,
Ohio State Univ., Columbus. Dept. of Zoology.
R. M. Vaga, and D. A. Culver.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-207331, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Center Completion Report, March, 1984. 81 p, 21 Fig, 5 Tab, 47 Ref. Project No. OWRT A-065-OHIO(1).

Descriptors: *Plankton, *Zooplankton grazing, Phytoplankton, Algae, *Bosmina, *Daphnia, Larval fish, Productivity, Bacteria, Nutrients, Population dynamics, *Ohio, Hebron National Fish Hatchery, *Trophic dynamics, *Fish yield, *Trophic levels, Ecology.

A three year study of the trophic dynamics of fish rearing ponds was conducted at the Hebron National Fish Hatchery, Hebron, Ohio to investigate questions concerning the interaction of various trophic levels in the plankton and to better understand the factors most responsible in determining fish yield. Investigation of the effects of zooplankton grazing on the size structure of the phytoplankton indicated that above certain threshold levels of zooplankton biomass, zooplankton grazing can radically change the size structure of the phytoplankton community. Small flagellates were susceptible to both Daphnia and Bosmina grazing whereas small cryptomanads were removed only by Daphnia. The dynamics of resistant algal forms to grazing was not possible to predict at the species level. The presence of filament concentrations in excess of 20% of total phytoplankton volume inhibited the egg production of Daphnia more than that of Bosmina. However, total seasonal reproductive output of both species was due to factors other than filament concentration and the effects of filaments on succession in the zooplankton is questioned. Fish predation was found to affect the per capita production of Daphnia and to have a large influence on the species composition of the zooplankton community. High levels of fish predation resulted in Bosmina becoming the dominant grazer but at the same time increased the reproductive rate in Daphnia, regardless of species.
W85-01833

STUDY OF HABITAT CONDITIONS OF THE MACROPHYTIC VEGETATION IN SELECTED RIVER SYSTEMS IN WESTERN LOWER SAXONY (FEDERAL REPUBLIC OF GERMANY),
Oldenburg Univ. (Germany, F.R.). Dept. of Biology.
G. Wiegleb.
Aquatic Botany, Vol. 18, No. 4, p 313-352, June, 1984. 3 Fig, 8 Tab, 99 Ref.

Descriptors: *Macrophytes, *Aquatic habitats, *Rivers, *Lower Saxony, *West Germany, Ecological distribution, Marshes, Vegetation, Analysis of variance, Cluster analysis, Aquatic plants, Dissolved oxygen, Turbidity, Velocity, Acidity, Calcium.

In Lower Saxony, ecological investigations were carried out in selected river systems. The vegetation of the 43 sampling sites was classified by means of cluster analysis into 7 groups, 3 of which occurred on the diluvial plains and 2 in the coastal marsh area only. Forty-one parameters were measured 3-7 times covering 2 vegetation periods. The structure of the data was carefully studied by bivariate correlation analysis and factor analysis. A high number of significant correlations was detected, which indicates difficulties in ecological interpretation. Temporal variation of the parameters measured was classified into 3 groups according to stability. For a study of the relationships between the vegetation and the ecological parameters, the data set was split into 5 subsets (physical data, water chemical data, interstitial water chemical data, sediment characteristics, and a mixed set of simple field data). The relationship of each subset to the vegetation was studied separately using cluster analysis. The mixed data set FIELD showed the highest degree of similarity to the vegetation clustering. The best vegetation type differentiation qualities were shown by some physical and water chemical parameters (oxygen content, turbidity, current velocity, acidity, calcium). The ecological behavior of some species of medium frequency was also studied in detail by means of analysis of variance. The means of all parameters for occurrence and non-occurrence were compared. For Ranunculus peltatus, Myriophyllum alterniflorum and Elodea canadensis, several differentiation variables could be detected. The zonation of two rivers was studied in detail by comparing the vegetation sequence with important physical and chemical parameters. The interaction between these parameter groups is clearly shown. Physical parameters like current velocity are responsible for the basic zonation, while chemical parameters can modify the zones to a large extent. (Moore-IVI)
W85-01887

FACTORS STRUCTURING FISH ASSEMBLAGES ALONG A BOG LAKE SUCCESSIONAL GRADIENT,
Wisconsin Univ.-Madison. Center for Limnology.
F. J. Rahel.
Ecology, Vol. 65, No. 4, p 1276-1289, August, 1984. 3 Fig, 8 Tab, 71 Ref.

Descriptors: *Fish, *Bog lakes, *Succession, *Wisconsin, Oligotrophic lakes, Multivariate analysis, Hydrogen ion concentration, Dissolved oxygen, Minnows, Perch, Acid lakes.

Three alternate and distinct fish assemblages were identified in 43 northern Wisconsin lakes encompassing a gradient from bog ponds to small, oligotrophic lakes having little bog character. Multivariate analysis of physical/chemical variables identified three general environmental factors that influence community type and species richness. These factors are: (1) habitat size and heterogeneity; (2) lake productivity-pH; and (3) winter oxygen concentrations. Ordination of lake fish assemblages along these environmental radients revealed that two factors, lake pH and winter anoxia, were especially crucial in determining assemblage type. Maintenance of these discrete assemblages is also the result of biotic interactions (exclusion of cyprinids due to predation or competition from centrarchids). A centrarchid assemblage dominates lakes across a wide range of habitat types and pH, providing winter anoxia does not occur. Lakes with low winter oxygen concentrations harbor a cyprinid assemblage if the pH is above 5.2-5.4. Lakes that are acidic and also have low winter oxygen contain only two physiologically hardy species comprising the Umbra-Perca assemblage: central mudminnow (Umbra limi) and yellow perch (Perca flavescens). Five fishless lakes had physical and chemical characteristics similar to lakes with an Umbra-Perca assemblage. Within the fish assemblages, no subgroups of closely associated species were evident. For Umbra-Perca lakes, few environmental differences were evident between lakes having (1) no fish, (2) central mudminnows only or, (3) yellow perch and central mudminnows. The sequential loss of species along a gradient from oligotrophic seepage lakes to bog ponds reflected the increased harshness of the chemical environment and the loss of near-shore habitat zones. Species that are specialized zooplanktivores, that utilize hard-bottom substrates for spawning or feeding activities, or that are intolerant of low pH were limited to lakes with little bog character. Lakes in intermediate stages of succession contained acid-tolerant species that are food and habitat generalists. Lakes near the final stages of senescence contained only yellow perch and central mudminnows. The location of bog lakes at the lower end of several environmental gradients makes them valuable sites for studying the influence of environmental factors and biotic interactions on the structure of aquatic communities. (Author's abstract)
W85-01891

PHYTOPLANKTON POPULATION DYNAMICS OF A SMALL RESERVOIR: EFFECT OF INTERMITTENT MIXING ON PHYTOPLANKTON SUCCESSION AND THE GROWTH OF BLUE-GREEN ALGAE,
McMaster Univ., Hamilton (Ontario). Dept. of Biology.
A. M. Trimbee, and G. P. Harris.
Journal of Plankton Research, Vol. 6, No. 4, p 699-713, 1984. 7 Fig, 2 Tab, 26 Ref.

Descriptors: *Phytoplankton, *Population dynamics, *Succession, *Algal growth, *Guelph Lake, *Ontario, Reservoirs, Cyanophyta, Diatoms, Seasonal variation, Anoxic conditions, Seasonal succession. .

The seasonal succession of the phytoplankton of a small reservoir (Guelph Lake, Ontario) in the spring-summer of 1982 was compared to that in 1981. Mixing of the deeper waters occurred several times throughout the summer in 1982 but not in 1981. The water at 10 m became anoxic for only 2 weeks in late July in 1982. In contrast, in 1981, the water at 10 m became anoxic at the beginning of July and remained so until mid-September. The phytoplankton dynamics observed in 1982 did not follow the typical progession from spring diatoms to summer species adapted to survive under stratified conditions, as in 1981. Diatoms were present throughout the summer in higher amounts in 1982 than in 1981. The most obvious difference in the two summers was the much greater abundance of Aphanizomenon flos-aquae in 1982. Other blue-green algae including Microcystis aeruginosa, Gomphosphaeria lacustris, and Lyngbya birgei appeared earlier on in 1982, but did not immediately increase in abundance as in 1981. In 1982, rates of phytoplankton community change were low in May and June and increases were observed in mid-July, early August, late August and late September. In contrast, in 1981, the rate community change increased in late May, mid-June, early July and late July and remained low throughout August and September. (Author's abstract)
W85-01916

WATER QUALITY OF LAKE ARLINGTON ON VILLAGE CREEK, NORTH-CENTRAL TEXAS, 1973 TO 1981,
Geological Survey, Austin, TX. Water Resources Div.
F. L. Andrews, and W. J. Gibbons.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigation Report 83-4196, 1983. 126 p, 18 Fig, 28 Tab, 14 Ref.

Descriptors: *Water quality, *Dissolved oxygen, Iron, Manganese, Nitrogen, Phosphorus, *Dissolved solids, Chloride, Sulfate, Hardness, Phytoplankton, *Texas, Lake Arlington, Village Creek, Thermal stratification.

Water in Lake Arlington on Village Creek in north-central Texas had volume-weighted average concentrations well below secondary maximum contaminant levels for drinking water for dissolved solids, dissolved chloride, and dissolved sulfate. The water was moderately hard. Thermal stratification in Lake Arlington usually begins during March or April and persists until October. Thermal stratification has resulted in significant seasonal and areal variations in the concentration of dissolved oxygen, dissolved iron, dissolved manganese, total inorganic nitrogen, and total phosphorus. Even through heated effluent from an electrical generating plant is returned to the reservoir at site C sub C and cause an elevation of water temperature, average dissolved oxygen levels at this site are not significantly different from levels at other sites. Dissolved iron and dissolved manganese were maximum during summer stagnation at site A sub C, a deep site near Arlington Dam. The concentrations of dissolved iron and dissolved manganese in water throughout the reservoir during winter circulation and in water near the reservoir surface during summer stagnation were quite low (less than 50 micrograms per liter). (USGS)
W85-02042

BOTTOM DYNAMICS IN LAKES,
National Swedish Environment Protection Board, Uppsala (Sweden). Water Quality Lab.
For primary bibliographic entry see Field 2J.
W85-02054

ENTRAINMENT, DEPOSITION, AND TRANSPORT OF FINE-GRAINED SEDIMENTS IN LAKES,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
For primary bibliographic entry see Field 2J.
W85-02055

PHYSICAL AND GEOCHEMICAL CHARACTERISTICS OF SUSPENDED SOLIDS, WILTON CREEK, ONTARIO,
National Water Research Inst., Winnipeg (Manitoba).
E. D. Ongley, M. C. Bynoe, and J. B. Percival.
Hydrobiologia, Vol. 91, p 41-57, July, 1982. 9 Fig, 1 Tab, 64 Ref.

Descriptors: *Wilton Creek, *Ontario, *Suspended solids, *Physicochemical properties, *Geochemistry, Storm runoff, Seasonal variation, Particle size, Calcium, Phosphorus, Magnesium, Aluminum, Titanium, Iron, Pottasium, Algae, Bioaccumulation.

To understand the nature of sediment-associated nutrient and contaminant transport dynamics in fluvial systems, a stormflow sampling program of suspended solids is reported for one water year in a representative rural diffuse source catchment of southeastern Ontario. Bulk samples of subsieve suspended solids were obtained using field-portable continuous-flow centrifuge apparatus. The physical and geochemical properties of suspended solids show no significant intersite differences over reaches of 1,500-2,000 m, yet display distinctive seasonal trends. Systematic seasonal changes in particle size, organic content, and Ca, P, Mn, Al, Ti, Fe, and K appear to reflect the changing role of partial area hydrology. Ca, P, and Mn are bioaccumulated by stream algae. Mineral signature is relatively constant over the year. (Author's abstract)
W85-02056

COMPARISON OF SEDIMENT ENERGY-TEXTURE RELATIONSHIPS IN MARINE AND LACUSTRINE ENVIRONMENTS,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2J.
W85-02058

GEOCHEMISTRY OF THE RHINE AND THE RHONE AND HUMAN IMPACT (LA GEOCHIMIE DU RHIN ET DU RHONE ET L'IMPACT HUMAIN),
Centre d'Ecologie de Camargue (France).
H. L. Golterman.
Hydrobiologia, Vol. 91, p 85-91, July, 1982. 2 Fig, 2 Tab, 7 Ref.

Descriptors: *Rhine River, *Rhone River, *Switzerland, *Geochemistry, Stream pollution, Water pollution, Environmental effects, Water quality.

The Rhine and the Rhone are two rivers very similar in their geological, hydrological and (geo)chemical characteristics. They originate from adjacent glaciers (in Switzerland); both pass through a limestone area and then through a deep lake, which collects most of the glacial silt. Both flow for a further 1 000 km while acquiring, more and more, the character of a lowland river. The chemistry of the water and the suspended matter was originally identical. On each, however, the influence of cultural development has been quite different. It is suggested that a detailed chemical desription of both river systems will be helpful to understand and reduce present-day pollution; very probably, to some extent, both rivers can serve as each other's baseline data. (Author's abstract)
W85-02059

WHOLE-LAKE LEAD BURDENS IN SEDIMENTS OF LAKES IN SOUTHERN ONTARIO, CANADA,
Ontario Ministry of the Environment, Rexdale.
For primary bibliographic entry see Field 5B.
W85-02062

HISTORICAL CHANGES IN ANTHROPOGENIC LEAD FALLOUT IN SOUTHERN ONTARIO, CANADA,
Trent Univ., Peterborough (Ontario).
For primary bibliographic entry see Field 5B.
W85-02063

BASIC CONCEPTS AND ASSOCIATED STATISTICAL METHODOLOGY IN THE GEOCHEMICAL STUDY OF LAKE SEDIMENTS,
Geneva Univ. (Switzerland). Inst. F.-A. Forel.
For primary bibliographic entry see Field 2J.
W85-02064

ZINC IN WATER AND SEDIMENTS OF TWO FINNISH LAKES,
Tampere Univ. of Technology (Finland).
For primary bibliographic entry see Field 5B.
W85-02065

CARBON FLOW ACROSS THE SEDIMENT-WATER INTERFACE IN LAKE VECHTEN, THE NETHERLANDS,
Limnologisch Inst., Nieuwersluis (Netherlands).
T. E. Cappenberg, K. A. Hordijk, G. J. Jonkheer, and J. P. M. Lauwen.
Hydrobiologia, Vol. 91, p 161-168, July, 1982. 4 Fig, 2 Tab, 20 Ref.

Descriptors: *Lake Vechten, *Netherlands, *Carbon, *Sediment-water interface, *Cycling nutrients, Organic matter, Chlorella, Algae, Chlorophyta, Isotope studies, Lakes.

The turnover and exchange rates, as well as the diffusion processes, concerning the input and output of carbon compounds at the mud-water interface, were studied. The carbon input rates were derived from the annual sedimentation rates of particulate organic matter (about 1,100 kg C/yr). The nature of the sedimented POC, and its breakdown pathways and turnover rates towards important metabolic intermediates in methanogenesis, were examined. The breakdown kinetics of Chlorella cell walls, a dominant green alga in Lake Vechten, was studied using U and C-14 labelled cell walls. The breakdown of the cell walls appears to be the rate-limiting step in anaerobic mineralization. Using first order kinetic equations, and HPLC and GLC and radio-chemical methods, turnover rate constants (k-values) of between 0.18 and 0.32/day and pool sizes of algal cell walls of 37 to 80 ug/g wet mud were found, giving turnover rates of 7.7 to 25.6 ug/g/day of cell wall material. The turnover rates (k-values between 0.07 and 0.31/h) of acetate, the most important breakdown product, and its concentration gradients (between 5 and 30 micromol) and diffusion coefficient (Ds = 0.0000022 sq cm/s) just in and above mud-water interface, was quantified. The diffusion of acetate, within the sediments, could not account for the turnover rates observed. Finally, from acetate flux data and from those on the rates of formation of carbon dioxide and methane, the output of carbon and its cycling in Lake Vechten are discussed. (Author's abstract)
W85-02066

LOADING CONCENTRATION MODELS FOR PHOSPHATE IN SHALLOW LAKES,
Centre d'Ecologie de Camargue (France).
H. L. Golterman.
Hydrobiologia, Vol. 91, p 169-174, July, 1982. 2 Fig, 3 Tab, 9 Ref.

Descriptors: *Phosphate, *Load distribution, *Loading concentration models, *Lakes, *Shallow water, Model studies, Calcium, Apatite, Iron, Lake sediments, Eutrophic lakes, Algal growth.

In shallow lakes, the quantitative influence of sediments on the phosphorous loading is different from that in deep lakes because through resuspension, the sediments are repeatedly brought into contact with the water. A theoretical mathematical formula was developed which describes the phosphate concentration in water and sediments of shallow lakes as a function of loading. In vitro experiments agreed, in principle, with the expected shape of the relationship curve. The curve shows that the phosphate concentration rises slowly during the early stages of eutrophication and that, later, a much more rapid increase can be expected. In the interstitial waters of shallow lake sediments lower pH values may occur than in the overlying water, and iron may control the phosphate concentrations

there. As algal growth takes place in the water, in most eutrophic shallow lakes, the Ca(2+) concentration and the pH will control the solubility of the phosphate surrounding these algae. The apatite system is just as important as Fe as a eutrophic-hard-water phosphate controlling mechanism. (Collier-IVI)
W85-02067

MODEL FOR INSTREAM REGULATION OF RADIOISOTOPES AND HEAVY METALS IN RIVERINE WATERS SUBJECTED TO A URANIUM MILL DISCHARGE,
Beak Consultants Ltd., Mississauga (Ontario).
For primary bibliographic entry see Field 5B.
W85-02068

EXPERIMENTAL MEASUREMENT OF SEDIMENT NITRIFICATION AND DENITRIFICATION IN HAMILTON HARBOUR, CANADA,
McMaster Univ., Hamilton (Ontario).
A. Klapwijk, and W. J. Snodgrass.
Hydrobiologia, Vol. 91, p 207-216, July, 1982. 6 Fig, 8 Tab, 6 Ref.

Descriptors: *Hamilton Harbour, *Ontario, *Sediments, *Nitrification, Nitrogen cycle, Effluents, Ammonia, Carbon, Sediment-water interface, Arrhenius activation energy, Lakes.

This research examines the role of sediment nitrification and denitrification in the nitrogen cycle of Hamilton Harbour. The Harbour is subject to large ammonia and carbon loadings from a waste-water treatment plant and from steel industries. Spring ammonia concentrations rapidly decrease from 4.5 to 0.5 mg/L, while spring nitrate concentrations increase from 1 to 2 mg/L, by mid-summer. A three-layer sediment model was developed. The first layer is aerobic; in it, oxidation of organics and nitrification occurs. The second layer is for denitrification, and the third layer is for anaerobic processes. Ammonia sources for nitrification include diffusion from the water column, sources associated with oxidation of organics, sources from denitrification and from anaerobic processes. Diffusion of oxygen, ammonia and nitrate across the sediment-water interface occurs. Temperature effects are modelled using the Arrhenius concept. A combination of zero-order kinetics for nitrate or ammonia consumption with diffusion results in a half-order reaction, with the respect to the water column loss rate of sediments. From experimental measurement, the rate of nitrification is 200 mg N/L sediment per day, while that of denitrification is 85 mg N/L sediment per day at 20 degrees C. The Arrhenius activation energy is estimated as 15 000 cal/mole-K and 17 000 cal/mole-K for nitrification and denitrification, respectively between 10 degrees C and 20 degrees C. Calculations of the flux of ammonia with the sediments, using the biofilm, compare favorably with experimental observations. The ammonia flux from the water column is estimated to account for 20% of the observed decreased in water column stocks of ammonia, while the nitrate flux from the water column is estimated to account for 25% of the total nitrogen produced by the sediments. (Author's abstract)
W85-02070

MASS BALANCE MODELS OF PHOSPHORUS IN SEDIMENTS AND WATER,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2J.
W85-02071

DYNAMIC PHOSPHATE BUDGET MODEL FOR A EUTROPHIC LAKE,
Technische Hogeschool Twente, Enschede (Netherlands).
L. Lijklema, and A. H. M. Hieltjes.
Hydrobiologia, Vol. 91, p 227-233, July, 1982. 10 Fig, 5 Ref.

Descriptors: *Lake Brielle, *Netherlands, *Phosphate budget, *Eutrophic lakes, *Model studies, Simulation, Sediments, Primary production, Mineralization, Sedimentation, Adsorption, Cycling nutrients, Lakes.

The relations between the external nutrient loading of lakes, recycling through sediments and the resulting productivity are complicated by feed-back mechanisms, seasonal variations and trends. Simulation is a useful tool for the identification of controlling factors and the assessment of the effects of management measures, supplementary to experimental research. The model variables in our dynamic phosphate budget model include inorganic and organic particulate phosphate and dissolved o-phosphate, in both sediments and overlying water. Sediments may be aerobic or anaerobic, depending on topography, temperature and composition. The major processes described are primary production, mineralization, sedimentation, adsorption and diffusion. Several model parameters have been estimated directly for Lake Brielle (Netherlands). The sediment dilution rate, the extent of anaerobic conditions and the number and character of adsorption sites are important controlling factors. (Author's abstract)
W85-02072

SPATIAL HETEROGENEITY IN WHOLE LAKE SEDIMENTS - TOWARDS A LOADING ESTIMATE,
Alberta Environment, Edmonton. Water Resources Mangement Div.
T. B. Reynoldson, Jr., and H. R. Hamilton.
Hydrobiologia, Vol. 91, p 235-240, July, 1982. 4 Fig, 4 Tab, 11 Ref.

Descriptors: *Lake Wabamum, *Alberta, *Lake sediments, *Nutrient loadings, Eutrophic lakes, Phosphorus, Isotope studies, Organic matter, Lakes.

Studies of nutrient loadings, to shallow culturally eutrophied Alberta lakes, suggest internal inputs are significant. In this regard, estimation of bottom sediment P loads to Lake Wabamun (80 sq km, 5.5 m mean depth) were examined. Initially we determined the spatial variability in Total Organic Content (% loss on ignition) and Total Phosphorus, as indicators. Phosphorus fractions and biologically available phosphorus (BAP) were measured at specific stations. These data showed a very uniform distribution in sediment type with a Total Organic Content of 40.6 +/- 3.3 (95% C.L.) at the west end, gradually declining to 26.3 +/- 0.9 at the east end. Transects performed at routine monitoring stations indicate the representativeness of each station, e.g., station 2, 40.8 +/- 1.3 (10 sites). One explanation of this uniformity is provided from Pb-210 analysis of shallow cores which indicate mixing to a depth of 16 cm. This is also thought to explain the mechanics of P loading to the water phase. Finally, Total Organic Content relates well to BAP ($r(2) = 0.80$). It is hoped that this simple technique may well permit more precise extrapolation to whole lake BAP estimates at least on this lake. (Author's abstract)
W85-02073

PARTITIONING OF PHOSPHORUS BETWEEN PARTICLES AND WATER IN A RIVER OUTFLOW,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Ecology and Systematics Section.
J. P. Barlow, and M. S. Glase.
Hydrobiologia, Vol. 91, p 253-260, July, 1982. 7 Fig, 1 Tab, 14 Ref.

Descriptors: *Cayuga lake, *New York, *Salmon Creek, *Phosphorus, *Particulate matter, Mixing zone, Adsorption, Chemical precipitation, Sedimentation, Nutrients.

The mixing zone between Cayuga Lake, N.Y. and one of its tributaries, Salmon Creek, was studied to determine effects of physical processes such as adsorption, precipitation or sedimentation on phosphorus discharge by the Creek. A high sodium concentration in the lake served as a natural tracer, by which proportions of Creek and Lake water were determined at any point in the mixing zone. Proportions of Creek and Lake water were used to predict amounts of P that would be expected on the basis of mixing alone. Differences between predicted and observed concentrations were attributed to local physical processes. In several of the six plumes surveyed, there was substantial loss of P due to sedimentation. The P-distribution in all plumes showed evidence of exchanges between particles and the medium, as a result of which soluble reactive-P usually decreased and soluble unreactive-P usually increased. The nature and magnitude of these local processes were such that they could have significant effects on the fate of stream-P discharged into the lake. (Author's abstract)
W85-02075

MICROBIAL METABOLISM IN SURFACE SEDIMENTS AND ITS ROLE IN THE IMMOBILIZATION OF PHOSPHORUS IN OLIGOTROPHIC LAKE SEDIMENTS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 2J.
W85-02076

ACCUMULATIVE PHASES FOR HEAVY METALS IN LIMNIC SEDIMENTS,
Technische Univ., Hamburg-Harburg (Germany, F.R.). Arbeitsbereich Umweltschutztechnik.
For primary bibliographic entry see Field 5B.
W85-02077

PHOSPHATE ADSORPTION KINETICS OF RESUSPENDED SEDIMENTS IN A SHALLOW LAKE, NEUSIEDLERSEE, AUSTRIA,
Vienna Univ. (Austria). Limnologische Lehrkanzel.
A. Gunatilaka.
Hydrobiologia, Vol. 91, p 293-298, July, 1982. 3 Fig, 1 Tab, 26 Ref.

Descriptors: *Neusiedlersee, *Austria, *Seston, *Suspended sediments, *Shallow water, *Phosphates, *Adsorption, Calcium, Langmuir isotherm, Isotherms, Lake sediments, Nutrients, Illite, Chlorite, Lakes.

Previous evaluations of phosphorus adsorption kinetics of lake sediments have used methods developed for soil science; most of the extraction procedures used in these investigations are from soil chemistry which involve the use of strong acids and alkalis that destroy some of the physical properties of natural samples. The phosphate adsorption capacity of suspended sediments from Neusiedlersee, (a 300 sq km, very shallow, highly turbid lake), was evaluated using a silicone oil-filter-centrifugation technique with P-32 and Tritium H2O labelling. This technique is quick, convenient and allows uptake processes to be followed during the first few seconds. The time dependent phosphate uptake was tested for concentration and pH dependency; the highest uptake was recorded at pH 9.00. The high calcite proportion in the sestonic material seems to influence the adsorption process; there is a high percentage of calcium bound phosphate in the seston sample. The other clay minerals present in the sample, such as illite and chlorite, have a high affinity for phosphates only at an acid pH. The kinetics of adsorption (at lake orthophosphate level and pH) could be explained by a biphasic Langmuir isotherm. The phosphate forms a monolayer when adsorbed on seston; adsorption taking place in various sites on the particle surface, or subsequent adsorption taking place in layers, may explain the two slopes in the isotherm. Adsorption may occur simultaneously on all sites, with higher energy sites being filled preferentially during the initial stages of adsorption. When the results are corrected for initial bound phosphate (assumed to be calcium bound phosphate 70.6%), the maximum phosphate adsorbed is equivalent to 588 micrograms/g seston (dry weight). (Collier-IVI)
W85-02079

DYNAMICS AND MECHANISMS OF ARSENITE OXIDATION BY FRESHWATER LAKE SEDIMENTS,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.

For primary bibliographic entry see Field 5B.
W85-02080

MANGANESE CYCLE IN LAC LEMAN, SWITZERLAND: THE ROLE OF METALLOGENIUM,
Geneva Univ. (Switzerland). Inst. F.-A. Forel.
J.-M. Jaquet, G. Nembrini, J. Garcia, and J. P. Vernet.
Hydrobiologia, Vol. 91, p 323-340, July, 1982. 11 Fig, 4 Tab, 37 Ref. Swiss National Research Foundation projects 2.606-0.76 and 2.314-0.79.

Descriptors: *Manganese, *Lac Leman, *Switzerland, *Metallogenium, *Bacteria, Lake sediments, Sediments, Interstitial water, Suspended solids, Scanning electron microscopy, Transmission electron microscopy, Sediment-water interface, Cycling nutrients, Zinc, Cadmium, Iron.

The manganese pathways in Lac Leman have been investigated on the basis of chemical analyses undertaken on water, suspended solids, bottom sediments and interstitial water samples. The various modes of occurrence of Mn have been determined by means of visual examination using SEM and TEM (scanning and transmission electron microscopy), by microanalysis (EDAX) of various sediment fractions, by chemical analysis of the dissolved phase, and by chemical speciation and XRD of bottom sediments. Fluxes to and from the sediment have also been computed. The time-depth variations of Mn in the water column are characterized by (a) a very steep gradient of Mn sol. from the sediment interstitial water (15 mg/L) to the overlying water, 2 m above the bottom (500 micro g/L), (b) an accumulation of Mn part. between 280 m and the interface at 310 m, consisting of mineralized colonies of Metallogenium. The abundance of Metallogenium colonies is inversely related to O2 concentration; the optimal value for the bacterium Mn fixation is around 1 mg/L. Because of the quasi-anoxic state of the bottom sediments and overlying water, Mn diffuses from a 'source layer', 2-5 cm below the interface (a) upwards across the interface, before being taken up by Metallogenium, and (b) downwards to a 'sink layer', in which large amounts of Mn-carbonate precipitate. Particulate Mn sedimentation rates measured in traps show that downwards Mn flux due to Metallogenium settling approximately balances the upwards soluble flux due to diffusion. Quantitatively, the process of Mn cycling in Lac Leman is, therefore, limited to the lowermost part of the hypolimnion. Although Zn and Cd seem to follow the same cycle as Mn, Fe behaves in a different manner; it was not taken up by Metallogenium at the time of our study. (Author's abstract)
W85-02081

PARTICLE SIZE DISTRIBUTION AND CHEMICAL PARAMETERS OF THE SEDIMENTS OF A SHALLOW TURBID IMPOUNDMENT,
Orange Free State Univ., Bloemfontein (South Africa). Dept. of Botany.
P. C. Keulder.
Hydrobiologia, Vol. 91, p 341-353, July, 1982. 15 Fig, 20 Ref.

Descriptors: *Wuras Dam, *South Africa, *Particle size, *Chemical properties, *Sediments, Sodium, Potassium, Calcium, Magnesium, Phosphorus, Phosphates, Passega classification.

As part of an ecosystem study of Wuras Dam, a small mesotrophic turbid impoundment in the semi-arid part of South Africa, an investigation was made of the particle size distribution, organic content and inorganic chemical composition of the sediment. Nine transects 50 m apart were made during February 1980. Sediments were sampled with an Eckman grab. The following analyses were made: size fractionation by wet sieving, cation exchange capacity, exchangeable Na, K, Ca, Mg and PO4, total P, and loss on ignition. From the results it was clear that the finer particles, in or near the original river bed, had higher cation exchange capacity, total P, exchangeable phosphorus and organic content. Littoral areas with avian habitat and extensive macrophyte vegetation, contained coarser sediments. Organic detritus apparently migrated to the deeper part of the impoundment. Sediments of lacustrine and fluvial origin were identified by means of the Passega classification. (Author's abstract)
W85-02082

INTERACTION BETWEEN INTERSTITIAL WATER AND SEDIMENT IN TWO CORES OF LAC LEMAN, SWITZERLAND,
Geneva Univ. (Switzerland). Dept. of Inorganic, Analytical and Applied Chemistry.
G. Nembrini, J. A. Capobianco, J. Garcia, and J.-M. Jacquet.
Hydrobiologia, Vol. 92, p 363-375, July, 1982. 7 Fig, 2 Tab, 35 Ref. Swiss National Research Foundation projects 2.606-0.76 and 2.314-0.79.

Descriptors: *Lac Leman, *Switzerland, *Interstitial water, *Iron, Vivianite, Siderite, Sulfides, Iron sulfides, Manganese, Trace metals, Lake sediments, Lakes.

The pore fluids of the sediments collected at the deepest point of Lac Leman (Switzerland) are supersaturated with respect to vivianite and siderite. In the presence of sulfide, the iron solubility is controlled entirely by the amorphous iron sulfides. As the iron (II) becomes dominant, the formation of siderite occurs and evidence of this, in the solid phase, can be obtained by the use of Mossbauer spectroscopy and some sequential chemical extractions. The amount of 'siderite iron' decreases from about 10% near the sediment surface to a few percent in the lower levels of the sediment (< 10 cm). Evidence for vivianite formation could not be obtained even in the lower layers, despite the precautions taken to avoid oxidation. Although the trace metal behavior in the solid phase is well correlated with the iron and manganese, availability in the pore fluid is dependent on the adsorption on, or co-precipitation with, finely dispersed colloids, which pass through a 0.45 micro m filter. Trace metal concentrations in pore fluid were directly related to total elemental concentrations in the solid phase, and did not reflect cumulative trends associated with anthropogenic enrichment. (Author's abstract)
W85-02084

RATES OF SEDIMENT-WATER EXCHANGE OF OXYGEN AND SEDIMENT BIOTURBATION IN LOUGH NEAGH, NORTHERN IRELAND,
New Univ. of Ulster, Coleraine (Northern Ireland). Limnology Lab.
B. Rippey, and D. H. Jewson.
Hydrobiologia, Vol. 92, p 377-382, July, 1982. 4 Fig, 28 Ref.

Descriptors: *Lough Neagh, *Northern Ireland, *Bioturbation, *Sediment-water interface, *Oxygen, *Lake sediments, Eutrophic lakes, Benthos, Chlorophyll a, Redox potential, Interstitial water, Advection.

Oxygen is transported 30 mm into the sediment at an 8 m depth site in eutrophic Lough Neagh by the irrigational activities of the benthic fauna. Faunal activity also mixes the upper 20 mm of sediment. Sediment oxygen uptake rate, redox potential-depth profile and the chlorophyll a concentration were measured in the upper sediment layers from February to November 1979. Chlorophyll a input to the sediment, following the Spring phytoplankton maximum, remained in the 0-1 cm sediment layer but did cause the redox potential profile to change from one with potentials around 400 mV in the upper 50 mm to one with a strong gradient over the 0-30 mm region. The start of benthic faunal activity in May caused the chlorophyll a to be mixed into the 1-2 cm layer and also caused oxygen to be transported into the sediment at a rate sufficient to change the redox potential back to its initial state. The biodiffusion coefficient for solids in the upper 20 mm was estimated to be (6 x 10 to the minus 8th power) sq cm/s. Oxygen transport in the pore waters of the upper sediment layers was considered to be best described as advection, caused by the irrigational activities of the benthic fauna. (Author's abstract)
W85-02085

VERTICAL STRATIFICATION IN SEDIMENTS FROM A YOUNG OLIGOTROPHIC SOUTH AFRICAN IMPOUNDMENT: IMPLICATIONS IN PHOSPHORUS CYCLING,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Botany.
A. J. Twinch, and C. M. Breen.
Hydrobiologia, Vol. 92, p 395-404, July, 1982. 6 Fig, 2 Tab, 42 Ref.

Descriptors: *Midmar Dam, *South Africa, *Phosphorus, *Oligotrophic lakes, *Sediments, Organic carbon, Hydrogen ion concentration, Aluminum, Adsorption, Phosphates, Sediment-water interface, Langmuir isotherms, Adsorption isotherms, Isotopic tracers, Lakes.

Changes at the mud surface in Midmar Dam, following impoundment, were studied by examining vertical profiles of selected parameters in sediment cores. Distinct stratification in organic carbon, pH and exchangeable Al(3+) was evident. Phosphate adsorption characteristics in the stratified sediments was quantified using Langmuir adsorption isotherms. The adsorption maxima and bonding energy constants in the surface sediments (0-3 cm) were markedly lower than those below 3 cm, indicating that the surface layers are less efficient at binding phosphate than the deeper layers. Radiotracer experiments indicate that the layers comprising the top 3 cm of sediment predominate in PO4-P exchange with the overlying water. (Author's abstract)
W85-02086

FLUX OF REDUCED CHEMICAL CONSTITUENTS (FE(2+), MN(2+), NH4(+) AND CH4) AND SEDIMENT OXYGEN DEMAND IN LAKE ERIE,
Wright State Univ., Dayton, OH. Dept. of Chemistry.
D. D. Adams, G. Matisoff, and W. J. Snodgrass.
Hydrobiologia, Vol. 92, p 405-414, July, 1982. 3 Fig, 4 Tab, 35 Ref. EPA contracts R 8057160 and R806756011, OWRT project A-059.

Descriptors: *Lake Erie, *Ammonium, *Methane, *Ferrous iron, *Manganese, *Iron, *Sediment oxygen demand, *Chemical reduction, Oxygen demand, Lake sediments, Dissolved oxygen, Sediment-water interface, Interstitial water, Lakes.

Sediment pore water concentrations of Fe(2+), Mn(2+), NH4(+) and CH4 were analyzed from both diver-collected cores and an in situ equilibration device (peeper) in Lake Erie's central basin. Sediment oxygen demand (SOD) was measured at the same station with a hemispheric chamber (including DO probe and recorder) subtending a known area of sediments. The average SOD was 9.4 mM/sq m/day (0.3 g/sq m/day). From pore water gradients within the near-surface zone, the chemical flux across the interface was calculated indirectly using Fick's first law modified for sediments. These calculations, using core and peeper gradients, always showed sediment loss to overlying waters, and variations between the two techniques differed by less than an order of magnitude for Fe(2+) and CH4. The transport of these reduced constituents can represent a sizeable oxygen demand, ranging from less than 1% for Fe(2+) and Mn(2+) to as high as 26% for NH4(+), and 30% for CH4. The average flux of these constituents could account for about a third of the SOD at the sediment-water interface of this station. (Author's abstract)
W85-02087

AVAILABLE PHOSPHORUS IN LAKE SEDIMENTS IN THE NETHERLANDS,
Northwestern Connecticut Regional Planning Commission, Warren, CT. Lake Waramaug Task Force.
S. P. Klapwijk, J. M. W. Kroon, and M. L. Meijer.
Hydrobiologia, Vol. 92, p 491-500, July, 1982. 3 Fig, 4 Tab, 21 Ref.

Descriptors: *Netherlands, *Phosphorus, *Lake sediments, *Algae, *Bioassays, Sediments, Phos-

phates, Nutrient uptake, Iron, Clays, Organic matter, Lakes.

The amount of phosphorus available to algae in the sediments of four lakes in the western part of the Netherlands has been assessed by means of chemical extractions and bioassay techniques. In addition to direct chemical sediment analyses, extractions were carried out with an NTA column method and a stepwise NH4 Cl-NaOH-HCl shaking method, the latter supposedly separating the weakly bound, the Fe- and Al-bound and the Ca-bound phosphates in the sediments. Bioassays, with sediment as the sole source of P, were made with Scenedesmus quadricauda in modified Skulberg's Z8 medium to determine the amount of phosphates available to algae. The average total P concentration of the sediments varid from 0.8 to 3.6 mg P/g dry wt and correlated well with the net external P loading of the lakes. Uptake of P by algae in the bioasssays varied from 0.4 to 36% while NTA extracted 36-69% of the total P. The ratio NH4Cl extracted/NaOH extracted/HCl extracted phosphates is different from lake to lake, although in all lakes the highest extractions (27-62% of total P) are found in the NaOH fraction. However, in the peaty sediments of these lakes, the NaOH step extracted not only the Fe- and Al-bound phosphates but, also, large amounts of humus compounds. Hence, this fraction also contains non-available organic P. The results are related to soil type and chemical characteristics of the sediments, and compared with data from other authors. A positive correlation was found between phosphate available to algae and NTA- and NaOH-extractable P, but the correlation with total phosphorus was higher. Algae-extractable P proved to be positively correlated with total iron and clay content and negatively with the amount of organic matter. The sediments in the investigated lakes show great variability and the chemical extraction techniques cannot replace the bioassays to assess the amount of phosphorus available to algae. (Author's abstract)
W85-02092

EPILIMNETIC NUTRIENT LOADING BY METALIMNETIC EROSION AND RESULTANT ALGAL RESPONSES IN LAKE WARAMAUG, CONNECTICUT,
Hoogheemraadschap van Rijnland, Leiden (Netherlands).
R. W. Kortmann, D. D. Henry, A. Kuether, and S. Kaufman.
Hydrobiologia, Vol. 92, p 501-510, July, 1982. 8 Fig, 1 Tab, 13 Ref.

Descriptors: *Lake Waramaug, *Connecticut, *Epilimnion, *Nutrient loading, *Metalimnion, *Algal growth, Cycling nutrients, Stratification, Phosphorus, Lake sediments, Secchi depth, Dissolved oxygen, Water temperature, Diffusion, Thermal stratification, Lakes.

Phosphorus regeneration from lake sediments, and subsequent migration to trophogenic surface water, significantly contributes to the lake nutrient budgets and algal bloom conditions in some lake types. Decomposition of organic matter in deep water and sediments results in the accumulation of regenerated nutrients, alternate electron acceptors (reduced products of anaerobic respirations = COD), carbon dioxide, and depletion of dissolved oxygen (electron acceptor in aerobic respiration). Thermal stratification creates spatial segregation of trophogenic and tropholytic environments in the lake, resulting in gradients between sediments, hypolimnion, and the epilimnion. Exchange of oxygen, nutrients, and reduced alternate electron acceptors between the hypolimnion and epilimnion affects the productivity of a lake. Secchi depth, temperature, and dissolved oxygen profiles were determined twice each week from May 1980 to October 1980 at each of five lake stations. Nutrient concentration profiles, including total soluble and total phosphorus, ammonium-N, nitrate, soluble Kjeldahl, and total Kjeldahl nitrogen were determined twice each month. Epilimnetic algal samples were collected twice each week using Kemmerer and water column 'straw' samplers. Cell counts of total, green, bluegreen, and diatom algae groups were made. Three methods were used to describe hypolimnetic-epilimnetic exchange, including coefficients of eddy diffusion (based on lake heat budget), a graphical method of defining thermocline location, and relative thermal resistance to mixing (RTRM, based on density differences). All three methods yielded comparable estimates of net seasonal transport. The graphical and RTRM methods described events occurring at shorter intervals (greater resolution). We find general agreement between the three methods of describing hypolimnetic-epilmnetic transport. The frequency of sampling resulted in increased resolution of thermal profiles (in time), allowing accurate estimation of short-term nutrient flux into epilimnetic waters. An algal bloom event occurred 5 to 12 days following erosion of the top of the metalimnion to below the aerobic-anaerobic interface. The lag time to peak algal concentration, following such events, decreased through the summer (June = 12 days, September = 5 days). (Author's abstract)
W85-02093

MECHANISMS FOR RELEASE OF SEDIMENT-BOUND PHOSPHATE TO WATER AND THE EFFECTS OF AGRICULTURAL LAND MANAGEMENT ON FLUVIAL TRANSPORT OF PARTICULATE AND DISSOLVED PHOSPHATE,
Ohio State Univ., Columbus. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W85-02095

ACIDIFIED LAKES: SEDIMENT TREATMENT WITH SODIUM CARBONATE - A REMEDY,
Lund Univ. (Sweden). Limnological Inst.
For primary bibliographic entry see Field 5G.
W85-02096

LAKE TREHORNINGEN RESTORATION PROJECT. CHANGES IN WATER QUALITY AFTER SEDIMENT DREDGING,
National Swedish Environment Protection Board, Uppsala (Sweden). Water Quality Lab.
For primary bibliographic entry see Field 5G.
W85-02097

SUMMER PEAK OF NUTRIENT CONCENTRATIONS IN LAKE WATER,
Japan Bottom Sediment Management Association, Tokyo.
For primary bibliographic entry see Field 5B.
W85-02098

DEEPWATER SEDIMENTS AND TROPHIC CONDITIONS IN FLORIDA LAKES,
Florida State Museum, Gainesville.
M. S. Flannery, R. D. Snodgrass, and T. J. Whitmore.
Hydrobiologia, Vol. 92, p 597-602, Jul, 1982. 4 Fig, 2 Tab, 12 Ref. NSF grant DAR 79-2418.

Descriptors: *Lake sediments, *Trophic level, *Eutrophication, *Florida, Lakes, Sediments, Aluminum, Iron, Calcium, Nitrogen, Phosphorus, Chlorophyll.

Sediment cores were taken from near maximum depth in 15 Florida lakes representing a wide range of trophic conditions. Chemical analyses of surface sediments showed Al, Fe, and Ca to be the most abundant elements in all samples, and the ratio of Al to Ca to be smaller for eutrophic lakes. Sediment organic matter increased with trophic state, as did the degree to which it was enriched in nitrogen. Corresponding sediment C/N ratios decreased with increasing lake trophic state and showed significant negative correlation with chlorophyll a, total N, and total P in the water column. The abrupt changes in the C/N ratios of the lake sediments may be indicative of dramatic changes in both trophic conditions and sedimentation rates. Before C/N ratios can be used along with sedimentary chlorophyll derivatives to indicate past trophic state, the sediment profiles must be reliably dated and compared to other fossil indicators of trophic condition. (Baker-IVI)
W85-02099

SEDIMENTATION RATES IN A SWISS-ITALIAN LAKE MEASURED WITH SEDIMENT TRAPS,
Commission of the European Communities, Ispra (Italy). Joint Research Centre.
For primary bibliographic entry see Field 2J.
W85-02100

CLIMATIC AND ANTHROPOGENIC EFFECTS ON THE SEDIMENTATION AND GEOCHEMISTRY OF LAKES BOURGET, ANNECY AND LEMAN,
Geneva Univ. (Switzerland). Inst. F.-A. Forel.
J. P. Vernet, and P.-Y. Favarger.
Hydrobiologia, Vol. 92, p 643-650, July, 1982. 4 Fig, 1 Tab, 3 Ref.

Descriptors: *Sedimentation, *Geochemistry, *Climate, *Environmental effects, *Lake Bourget, *Lake Annecy, *Lake Leman, *France, *Switzerland, Palynology, Carbonates, Organic carbon, Heavy metals, Eutrophication, Lakes.

During the last glaciation, the Rhone glacier extended as far as the region of Lyon and covered Lakes Bourget, Annecy and Leman. Glacial retreat successively freed Lakes Bourget and Annecy, it reached Geneva around 14 000 B.P. and the head of Lake Leman at about 12 000 B.P. Deposits situated between Nyon and the foot of the Jura provide a complete palynological zonation and serve as a type section for the lake core studies. A palynological horizon (about 1 800 A.D.) has been found in Lake Bourget and wood has been dated at 3 230 +/- 65 B.P. (C-14) in a core from Lake Leman. Three 6 m cores from each lake were sampled together with many 0.5 m cores from Leman. The short Lake Leman cores have been dated by Cs-137 and provide a precise indication of changes in the basin during recent decades. Holocene climatic variations are evident in the Leman cores and are reflected by concentrations of carbonate and organic carbon which increase at the end of the Allerod and reach a maximum in the Atlantic Period (climatic optimum). Human settlement began at the beginning of the Christian era. All the cores show increases in the organic matter and nutrients; from the turn of the century in the Leman, and later for the other lakes where eutrophication started only a few decades ago. NAI-P shows a very recent increase, around 1965 in the Leman. Heavy metals (Hg, Cd and Pb) show increases at about 30 years ago in Annecy, at about the turn of the century in Lake Leman and in the mid-19th century in Lake Bourget. (Author's abstract)
W85-02102

SEASONAL STUDY OF METHANE OXIDATION IN LAKE WASHINGTON,
Washington Univ., Seattle. Dept. of Microbiology.
M. E. Lidstrom, and L. Somers.
Applied and Environmental Microbiology, Vol. 27, No. 6, p 1255-1260, June, 1984. 4 Fig, 3 Tab, 12 Ref. USDA grant 5901-0410-8-0154-0.

Descriptors: *Methane, *Oxidation, *Lake Washington, *Washington, Seasonal variation, Methane bacteria, Sediment-water interfaces, Sediments.

The distribution of methane and methane-oxidizing bacteria in the water column of Lake Washington was determined monthly for 1 year. The methane profiles were relatively constant, with little stratification and low concentrations (0.05 to 0.5 micro M). The number of methane-oxidizing bacteria detected by a filter-plating method was routinely < 1/ml throughout the water column, and no incorporation or oxidation of methane was detected by radioisotopic labeling, even after methane was added. However, samples taken from the sediment-water interface contained as much as 3 micro M methane and 50 CFU of methane-oxidizing bacteria per ml and showed significant rates of methane oxidation and incorporation. To define the region of maximum activity more precisely, vertical profiles of the sediment were examined. The concentration of methane increased with depth to a maximum of 150 to 325 micro M at 2.5 cm, and significant rates of methane oxidation were found within

the top 2.5 cm. The apparent Kms for methane and oxygen were determined for samples from the top 1.0 cm of the sediment and found to be ca. 10 and 20 micro M, respectively. Projected values for methane oxidation rates suggested that maximum methane oxidation occurred in the top 0.5 cm of the sediment. (Author's abstract)
W85-02134

DEPENDENCE OF HYPOLIMNETIC OXYGEN CONSUMPTION ON AMBIENT OXYGEN CONCENTRATION: FACT OR ARTIFACT,
McGill Univ., Montreal (Quebec). Dept. of Biology.
R. J. Cornett, and F. H. Rigler.
Water Resources Research, Vol. 20, No. 7, p 823-830, July, 1984. 7 Fig, 4 Tab, 35 Ref.

Descriptors: *Dissolved oxygen, *Hypolimnion, *Oxygen depletion, Aerobic respiration, Lake sediments, Chemical reactions, Seasonal variation.

Ten lakes studied in this investigation and the data presented by previous authors are all consistent with the hypothesis that rates of oxygen depletion in the hypolimnion of lakes do not depend upon the ambient oxygen concentration over the range of concentrations from 12 mg/L to 1.0 mg/L. By definition, aerobic respiration must stop when there is no more oxygen present. Therefore the hypolimnetic oxygen deficit can be modeled as a zero-order chemical process that is independent of oxygen concentration. Predictions of seasonal changes in hypolimnetic oxygen concentrations can be made by estimating the slope of the linear regression of oxygen concentration against the Julian day when the sample was collected. (Author's abstract)
W85-02149

2I. Water In Plants

STOMATAL CONTROL OF WATER USE EFFICIENCY IN POPLAR CLONES AND HYBRIDS,
Toronto Univ. (Ontario). Faculty of Forestry.
T. J. Blake, T. J. Tschaplinski, and A. Eastham.
Canadian Journal of Botany, Vol. 62, No. 7, p 1344-1351, July, 1984. 16 Fig, 2 Tab, 19 Ref.

Descriptors: *Water use efficiency, *Stomatal transpiration, *Poplar, Transpiration, Trees, Productivity, Leaves, Plant tissue.

Water use efficiency (WUE, the ratio of dry matter produced to water used in transpiration) was studied in 17 poplar clones and hybrids. Although WUE could not be predicted from the poplar group alone, water efficiency was found to vary in different poplar genotypes. For example, a balsam poplar, Populus maximowiczii M-4 (section Tacamahaca), and a white poplar clone, P. alba A-499 (section Leuce), had twice the dry matter production per unit of water transpired compared with another clone of P. maximowiczii (M-13) and a cottonwood clone, P. nigra N-80 (section Aegeiros), which showed low WUE. The reduced transpiration in water-efficient clones per unit of dry matter produced was associated with a higher stomatal resistance on the abaxial leaf surface. However, the physiological and morphological basis of WUE varied in different clones. Water-efficient clones exhibited one or more of the following adaptations restricting water loss: (i) conspicuous cuticular ledges or hairs above the pore openings of stomata, (ii) earlier partial stomatal opening in the morning, and (iii) smaller stomata and a lower stomatal frequency on the adaxial surface of the upper leaves. Poplar clones of low WUE exhibited less stomatal control of transpiration as a result of lower stomatal resistances and they lacked the above adaptations. Relative ranking of genotypes could not be predicted from either dry matter productivity or transpiration rate alone although the most water efficient clones generally exhibited lower transpiration rates compared with less efficient clones. (Author's abstract)
W85-01646

PHENOLOGY AND WATER RELATIONS OF THREE PLANT LIFE FORMS IN A DRY TREE-LINE MEADOW,
Washington Univ., Seattle. Dept. of Botany.
L. E. Jackson, and L. C. Bliss.
Ecology, Vol. 65, No. 4, p 1302-1314, August, 1984. 6 Fig, 2 Tab, 42 Ref. NSF grants DEB 79-13421 and DEB 78-23260.

Descriptors: *Drought, *Phenology, *Plant physiology, *Meadows, Soil water, Polygonum, Penstemon, Saxifraga, Dormancy, Stomatal transpiration, Conductance, Plant growth, Reproduction, Leaf water potential, Snowmelt.

The relationship between physiological and phenological adaptions to drought was examined in three species of different life form in a tree-line meadow in the Sierra Nevada. Soil moisture in this meadow is predictably high following snow melt, but decreases through the summer because of infrequent precipitation. There were large differences among the life forms in allocation patterns and in vegetative and reproductive phenologies, but there were no comparable differences in their water relations. The annual Polygonum minimum and the hemicryptophyte Penstemon heterodoxus respond to decreasing soil moisture by reducing conductance; they consequently maintain a longer activity period. The geophyte Saxifraga aprica has little stomatal control of water loss and becomes dormant as soils dry. Penstemon heterodoxus is a long-lived perennial with an intermediate root:shoot ratio (1.9), evergreen leaves, and a high allocationn to vegetative structures. Leaf growth occurs during the first part of the season, while the soil is moist. Flowering begins at the end of shoot growth, and fruits dehisce 3 mo after snow melt. During a dry summer, plants were observed to lose many leaves; 25% of the plants died, and none of the remaining plants flowered the next year. Although Penstemon decreases conductances under a limited range of leaf water potential, it is still not well adapted to long dry periods. Polygonum minimum is a very small annual with a low root:shoot ratio (0.15) and an indeterminate growth pattern. After a period of solely vegetative growth, leaves and floral structures produced continually until psi soil reaches - 5 MPa. Seeds dehisce about 2 mo after snow melt. Total seed production is a function of the length of the growth period. Regulation of water balance by stomatal control assures adequate time for fruit production. Other annuals in the community had a very similar phenological pattern. Saxifraga aprica has a high root:shoot ratio (5.0) and a small basal rosette of leaves. Leaf growth occurs for only 2 wk and is followed immediately by flowering. Only 5-10% of the plants flower each year. Fruits mature 5 wk after snow melt, and plants become dormant at - 0.5 MPa or within 6 wk of snow melt. This species and the other ephemeral geophytes complete their growth during the period of predictable high soil moisture, and therefore require little ability to regulate water balance. This study provides evidence that high diversity in life forms is maintained in environments with high yearly variability in the lengths of the drought and snow-free periods. No single set of phenological and physiological characteristics is optimally adapted to the variability in the subalpine environment that was studied, and therefore several adaptive strategies co-occur. (Author's abstract)
W85-01892

WATERLOGGING TOLERANCE OF LOWLAND TREE SPECIES OF THE SOUTH,
Clemson Univ., SC. Dept. of Forestry.
D. D. Hook.
Southern Journal of Applied Forestry, Vol. 8, No. 3, p 136-149, August, 1984. 2 Fig, 2 Tab, 79 Ref.

Descriptors: *Trees, *Flooding, *Waterlogging tolerance, Seedlings, Soil saturation, Soil-water plant relationships.

Waterlogging tolerance refers to a species' ability, from seedling stage to maturity, to tolerate soil saturation or inundation during the growing season. Many tree species in the South are adapted to periodic and/or prolonged soil waterlogging. Previously published waterlogging-tolerance ratings, a frequency-occurrence scheme, and a new relative waterlogging-tolerance rating are presented in a table for southern lowland tree species. The relative waterlogging tolerance ratings can be used to predict in general what may happen to the population of a species in question under specific conditions. In doing so, one must take into account the prior waterlogging history of the population, age, general vigor of the trees, type, duration, frequency, and timing of waterlogging. (Moore-IVI)
W85-02111

AGRICULTURAL DROUGHTS AT PEDDAPURAM, EAST GODAVARI DISTRICT, ANDHRA PRADESH,
Andhra Univ., Waltair (India). Dept. of Meteorology and Oceanography.
A. R. Subramaniam, and A. V. Rao.
Mausam, Vol. 34, No. 4, p 439-442, 1983. 2 Fig, 1 Tab, 2 Ref.

Descriptors: *Drought, *Millet, *Crop yield, *Peddapuram, *India, Soil water, Forecasting, Water balance, Plant growth, Rainfall, Ragi.

Agricultural drought was studied in relation to ragi (finger millet) grown under rainfed conditions at Peddapuram, India. Weekly meteorological data and yield data were analyzed for the period 1960 to 1976. The regression relationship between the yields of ragi and seasonal index of moisture adequacy was developed for forecasting of crop yield. The index of moisture adequacy and soil moisture as a percentage of available moisture capacity are computed during phenological stages of crop growth for the years of highest, normal and lowest yields. For these years weekly water balance patterns are also presented. For the highest yield year (1964), soil moisture never fell below 50% during the growth period. It never fell below 40% in any week of the growing season in 1960 when average yield was reported. Soil moisture only reached 50% once during the crop growth period in the year (1965) when the crop failed completely. (Moore-IVI)
W85-02126

WATER BALANCE AND CROPS IN KARNATAKA,
Andhra Univ., Waltair (India). Dept. of Meteorology and Oceanography.
A. R. Subramaniam, and A. V. R. Kessavo Rao.
Mausam, Vol. 35, No. 1, p 55-60, 1984. 9 Fig, 1 Tab, 8 Ref.

Descriptors: *Hydrologic budget, *Plant water potential, *India, *Climatic data, *Crop production, Rice, Kharif jowar, Rainfall, Evaporation rate, Evapotranspiration, Water deficit, Moisture availability.

Karnataka, the sixth largest state in India, has a range of moist climates that allows a wide variety of crops. Climatic water balance data and indices have been calculated for all the available meteorological stations in the State and they are cartographically analyzed. The general distribution of crops and the results of the analysis of moisture adequacy are compared to identify the limits of moisture adequacy for certain important crops like rice, jowar, baijra, ragi, sugarcane, groundnut, cotton and coffee. In Kharif season, high production yields of jowar are generally being recording in areas of 70% moisture adequacy. (Wheatley-IVI)
W85-02127

WATER HYACINTH CANOPY AND PAN EVAPORATION,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 4A.
W85-02128

2J. Erosion and Sedimentation

ELEMENTAL COMPOSITION OF SUSPENDED PARTICLES FROM THE YELLOW AND YANGTZE RIVERS,
Lamont-Doherty Geological Observatory, Palisades, NY.
Y.-H. Li, H. Teraoka, T.-S. Yang, and J.-S. Chen.
Geochimica et Cosmochimica Acta, Vol. 48, No. 7, p 1561-1564, July, 1984. 2 Fig, 1 Tab, 14 Ref. DOE grant EW 76-S-02-2185.

Descriptors: *Chemical composition, *Suspended sediments, *Yellow River, *Yangtze River, *China, *Kansu Province, Loess, Erosion, Soil chemistry, Trace metals, Calcium carbonate, Strontium, Zinc, Copper, Nickle, Cobalt, Lead, Water pollution sources.

Most of the suspended particles downstream of the Yellow River are supplied by intensive erosion of the loess terraces of China. The elemental composition of Yellow River suspended particles sampled in 1980 and 1981 closely resembles that of a Malang loess obtained from the Kansu Province (5.5 m below soil surface). The high concentration of Ca and Sr in both samples represents the occurrence of CaCO3 minerals. The concentration of Zn, Cu, Ni, Co and Pb in the suspended particles are higher in the Yangtze River than in the Yellow River; concentrations of these same elements in the Yellow River suspended particles are much closer to those of the world's average soils than those of the world's average river suspended particles indicating that the pollution input of these trace metals in the Yellow River is minor as compared with the natural inputs. (Collier-IVI)
W85-01703

FORESTS, FLOODS, AND EROSION: A WATERSHED EXPERIMENT IN THE SOUTHEASTERN PIEDMONT,
Georgia Univ., Athens. School of Forest Resources.
J. D. Hewlett, and R. Doss.
Forest Science, Vol. 30, No. 2, p 424-434, June, 1984. 4 Fig, 2 Tab, 16 Ref.

Descriptors: *Erosion, *Forest management, *Flooding, *Georgia, *Forest watersheds, Forestry, Floods, Erosion, Storm runoff, Clearcutting, Cutting management, Road construction.

A paired watershed experiment to determine the effect of clearcutting and regeneration of pine on the Georgia Piedmont showed that the small stormflows on dry soil may be increased 50 percent or more, but that larger flood discharges from wet soil were increased only 10 to 15 percent, if at all. The annual flood is apt to be of the latter type. The reasoned conclusion is that concern about the effects of forest operations on downstream flooding of creeks and rivers is unwarranted. However, peak rates of discharge immediately below the operation increased 30-45 percent, resulting in a 55-percent annual increase in stormflow erosivity during the 4-year cycle of harvesting, site preparation, and machine planting. The increase in erosivity of stormflows following this typical southern forestry operation, when considered in light of the accompanying increase in erosion hazard due to soil disturbance, warns the forest manager to increase his vigilance over road design, the selection of regeneration methods, and the maintenance of streamside protection zones. (Author's abstract)
W85-01705

DESIGN OF ARMOUR SYSTEMS FOR THE PROTECTION OF RUBBLE MOUND BREAKWATERS,
Baird (W.F.) and Associates, Ottawa (Ontario).
W. F. Baird, and K. R. Hall.
Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 164-176, June, 1984. 10 Fig, 41 Ref.

Descriptors: *Wave action, *Breakwaters, *Design criteria, *Armor layers, Model studies, Concrete costruction, Erosion control, Beach erosion.

Wave protection systems, or armor layers, evolved as breakwaters consisting of dumped stones or quarry run built in deeper water and at locations exposed to increasingly severe environmental loadings. There are two basic design methods, one involving the use of hydraulic model studies, the other involving the use of empirical equations that relate wave height to the weight of the armor unit. Both procedures have many limitations. Use of these design procedures in recent years have led to damage of many breakwaters. Well designed and carefully executed model studies are an essential part of the design of a large rubble mound structure located in deep water. Many of the rubble mound breakwaters existing today that have not been damaged contain an armor layer designed to be stable without the assistance of interlocking between units. The full potential of armor stones in protecting a breakwater has not been realized. Armor layers consisting of quarried stones could be used at many locations where more expensive and problematic concrete units have been used in the past, if innovative designs are used in place of traditional concepts. (Collier-IVI)
W85-01707

MORPHOLOGY AND RECENT SEDIMENTS OF THE LOWER ANASTOMOSING REACHES OF THE ATTAWAPISKAT RIVER, JAMES BAY, ONTARIO, CANADA,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
W. A. King, and I. P. Martini.
Sedimentary Geology, Vol. 37, No. 4, p 295-320, February, 1983/1984. 16 Fig, 2 Tab, 31 Ref.

Descriptors: *Attawapiskat River, *Ontario, *Sediments, *River morphology, *Channel morphology, Nival regime, Sediment transport, Floods, Anastamosis, Ice rafting, Ice jams, Sedimentation, Sedimentary structures.

The Attawapiskat River is one of the major low-gradient rivers which cross the flat wetlands of the Hudson Bay Lowland. It has a nival regime leading to strong, short-duration spring floods during which considerable amount of sediment is carried. For the remainder of the year only organic matter is transported in solution and suspension. The land is isostatically rebounding after the Pleistocene glaciations. The river downcuts through the softer Holocene estuarine basal clays and the Pleistocene tills, to the Paleozoic carbonate bedrock. The river develops an anastomosing pattern in the lower reaches and it acquires an irregular meandering character inland. It does not construct a significantly thick delta as the river-borne sediments are dispersed along the coasts by tides, longshore currents and ice rafting. The river is subjected to frequent ice jams its lower reaches as warmer southern waters flow toward the still frozen mouth and sea. During the jams, secondary channels become active, flooding develop and sedimentation occurs on the levees. Ice scours and ice-rafted materials affect the river banks greatly. The principal sedimentary environments within the river consist of: (1) erosional shoals covered by boulder and pebble lags over till; (2) sorted coarse to medium-sized sands in junction bars downstream from islands; these sands frequently develop gas bubbles, and they contain characteristic fining-upward sequences from boulder pavements at the base, grading up into rippled sand with abundant organic matter, grading up into laminated silt and sand and organic matter; (3) secondary channels, which develop thin silty and clay drapes on eroded hard substratum and are filled eventually by thick peats; and (4) river banks which show well-developed regressive sequences from Pleitocene tills at the base, overlain by estuarine sparsely fossiliferous clays, capped by thin conglomeratic units with abundant reworked Macoma balthica shells, grading upward into upper tidal flat sand, irregularly laminated sand and silt of marshes, and result interbedding of sand, silt and organic layers of the levees at the top. (Author's abstract)
W85-01734

SANTA ANA RIVER: AN EXAMPLE OF A SANDY BRAIDED FLOODPLAIN SYSTEM SHOWING SEDIMENT SOURCE AREA IMPRINTATION AND SELECTIVE SEDIMENT MODIFICATION,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
B. E. Haner.
Sedimentary Geology, Vol. 38, No. 1/4, p 247-261, March, 1984. 8 Fig, 18 Ref.

Descriptors: *Santa Ana River, *Floodplains, *Braided streams, *Sediments, Sediment sources, Sediment modification, Geomorphology, Sediment erosion, Particle, Sedimentation, Channel morphology.

The Santa Ana River floodplain can be divided into five geomorphic environments recognized by both morphology and sedimentary characteristics: braided channels, bars, vegetated islands, sand flats and floodplain terraces. The drainage basin discharge is dominated by the regional Mediterranean climate. The coarse channel sediment reflects the large temporal variations in drainage discharge and the resulting greater variability and competence to transport sediment. Major decreases in channel width during both seasonal summer drought and prolonged periodic drought exposes large areas of the floodplain to selective wind winnowing of fluvially derived sediment. This process operates on a small scale today, but during arid conditions in the late Wisconsin interglacial interval (prior to 22,000 yr B.P.) extensive sand flats along the Santa Ana River, distal alluvial fans, and sediment from minor tributaries were the sediment source for a major riverine dune field adjacent to the floodplain. Santa Ana River sediments originate from two distinct geologic provinces: the San Gabriel-San Bernardino granitic and metamorphic complex to the north and the granitic Perris Block to the south. Settling-tube analysis of sediments from tributary streams draining the Perris Block shows a distinctive bimodal distribution characterized by minimal sediment in the very coarse sand size (-1 to 0 phi size) inherited from the granitic grus parent material. Transportation results in sediment erosion; sediments are better sorted and finer grained with increasing distance from their source. A particle population is dependent upon grain size distribution at the initial source. Sediment populations are modified by subsequent erosion, selective grain-size transport deposition, and total deposition and mixing of several source areas. (Author's abstract)
W85-01735

SEDIMENTATION OF ORGANIC AND INORGANIC PARTICULATE MATERIAL IN LINDASPOLLENE, A STRATIFIED, LAND-LOCKED FJORD IN WESTERN NORWAY,
Bergen Univ. (Norway). Inst. of Marine Biology.
For primary bibliographic entry see Field 2L.
W85-01767

SEDIMENT TRANSPORT IN THE TANANA RIVER NEAR FAIRBANKS, ALASKA, 1982,
Geological Survey, Anchorage, AK. Water Resources Div.
P. E. Harrold, and R. L. Burrows.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4213, 1983. 53 p, 21 Fig, 35 Tab, 8 Ref.

Descriptors: Bed material, Bed material samplers, *Bedload, Bedload samplers, *Fluvial sediment, Geomorphology, Particle size, River hydraulics, *Sediment discharge, *Sediment load, Sediment transport, Suspended load, *Tanana River, *Alaska, Helley-Smith bedload sampler.

Suspended-sediment and bedload-transport rates for the Tanana River near Fairbanks can be related to water discharge, and annual sediment loads can be computed using these relations. For a site at Fairbanks the annual loads in 1982 were 26.1 million metric tons of suspended sediment and 227,000 metric tons of bedload. Data collected at five other sites within a 40-kilometer reach of the river indicate similar suspended-sediment-transport relations but bedload-transport relations varied from site to site. For all sites bedload is about 1 percent of

suspended-sediment load. Particle-size distribution of suspended sediment is similar at all six sites. Median particle size is generally in the silt range; only occasionally is it in the very fine sand range. Median particle size of bedload ranged from the gravel range to the medium sand range at four of the six sampling sites. At the farthest downstream site, Byers Island, and the farthest upstream site, above Chena River Floodway, median particle size of bedload was always in the sand range. (USGS)
W85-01769

SEDIMENT TRANSPORT IN THE TANANA RIVER NEAR FAIRBANKS, ALASKA, 1980-81,
Geological Survey, Anchorage, AK. Water Resources Div.
R. L. Burrows, and P. E. Harrold.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4064, 1983. 116 p, 42 Fig, 60 Tab, 8 Ref.

Descriptors: *Bed material, Bed material samplers, Bedload, Bedload samplers, Fluvial sediment, Geomorphology, Particle size, River hydraulics, Rivers, Sediments, Sedimentation, Sediment discharge, *Sediment load, *Sediment transport, Suspended load, Tanana River, *Alaska, Helley-Smith bedload sampler.

Suspended-sediment- and bedload-transport rates for the Tanana River near Fairbanks, Alaska, can be related to water discharge. Annual sediment loads can be computed using these relations. For a site at Fairbanks, the annual loads in 1980 were 22.0 million metric tons of suspended sediment and 272,000 metric tons of bedload; in 1981, 27.3 million metric tons of suspended sediment and 333,000 metric tons of bedload passed the Fairbanks site. Data collected at five other locations within a 40 km reach of the river indicate very similar suspended-sediment transport relations, but bedload-transport relations vary from site to site and between 1980 and 1981. For all sites bedload is usually 1 to 1.5 percent of suspended-sediment load. Particle-size distribution for suspended sediment is similar at all six sites. Median particle size is generally in the silt range; only occasionally is it in the very fine sand range. Median particle size of bedload varied from the gravel range to the medium sand range for five of the six sampling sites in both years. At the sixth site, the most downstream location, median particle size of bedload was in the sand range. (USGS)
W85-01788

DAILY WATER AND SEDIMENT DISCHARGES FROM SELECTED RIVERS OF THE EASTERN UNITED STATES: A TIME-SERIES MODELING APPROACH,
Geological Survey, Lakewood, CO. Water Resources Div.
M. J. Fitzgerald, and M. R. Karlinger.
Available from the Distr. Br., USGS, 604 S. Pickett St., Alex., VA 22304. USGS Water Supply Paper 2216, 1983. 24 p, 14 Fig, 7 Tab, 24 Ref.

Descriptors: *Model studies, Statistical models, *Hydrologic data, *Spectral analysis, Time-series modeling, *Sediment discharges, *Atlantic drainage.

Spectral and time-domain techniques were applied to daily water and sediment-discharge records from selected rivers of the eastern United States. Time-series models are constructed for analysis of the runoff-sediment yield system. Logarithmic transformation and first-order differencing of the data sets produced second-order, stationary time series and removed seasonal trends. Cyclic models accounted for less than 42 percent of the variance in the water series and 31 percent in the sediment series. Spectral results indicate frequently occurring storm runoff can account for as much as 50 percent of the variation in sediment discharge. Coherence and phase spectra indicate that a linear representation is reasonable for the water-sediment system. Transfer-function models that incorporate water discharge as input prove superior to univariate techniques in modeling and prediction of sediment yields. The random component that includes errors in measurement and model hypothesis indicates no serial correlation. The unit step-response function, calculated from impulse-response weights, can serve as an index of sediment production within or between drainage basins. (USGS)
W85-01823

EROSION AND SEDIMENTATION CHRONOLOGY OF THREE WATERSHEDS IN MARYLAND,
Maryland Univ., College Park. Dept. of Geology.
A. V. Segovia, J. D. Foss, D. Fanning, and G. Demas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-207356, Price codes: A07 in paper copy, A01 in microfiche. Maryland Water Resources Research Center, College Park, Publication No. 77, August, 1983. 126 p, 13 Plates, 13 Tab, 23 Fig, 96 Ref, 3 Append. Project No. OWRT A-058-MD(1), Contract/Grant No. 14-34-0001-2122.

Descriptors: Carbon radioisotopes, *Erosion, *Sedimentation, *Small watersheds, Diatoms, Residual soils, Deposition, Soil horizons, Soil profiles, *Phytoliths, Vertical succession, Deforestation, Cultivation, *Maryland, *Soil erosion.

Three small watersheds located in the Piedmont and Eastern Shore of Maryland were studied. The investigation included descriptions of residual and depositional soils. Buried soil horizons were dated by Carbon-14. In addition, phytoliths were studied to identify the vegetation contemporaneous with the deposition of soil levels. The presence of vertical successions of soil profiles indicate that rates of erosion and redeposition of soils varied in the last thousand years. Noticeable soil horizons were formed during long periods of slow erosion and little deposition, following short intervals of fast erosion and redeposition. Soil erosion was strong after the European contact, as a result of deforestation and intensive agricultural use of the land. The pre-European surface is buried in the lower part of the watersheds to depths of up to 130 centimeters (4+ ft) and the average rate of erosion for the last 300 years is interpreted to have been close to two tons per acre per year. The soil profile buried under post European-contact sediments indicates a period of moderately fast erosion. The presence of corn phytoliths in this part of the section, the scarcity of grass phytolith and the presence of diatom tests in the soils of a closed depression suggest that erosion was caused by slash-burn methods of agriculture. Thus, the last two episodes of accumulation are ascribed to non-climatic causes in contrast to previous episodes during the Holocene which were probably caused by climatic fluctuations. The study also demonstrated the feasibility of using phytoliths to interpret soil discontinuities in Maryland and to reconstruct past environmental conditions and sequences of dry and wet periods.
W85-01835

ESTIMATES OF DISSOLVED AND SUSPENDED SUBSTANCE YIELD OF STREAM BASINS IN MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 5A.
W85-01942

SEDIMENT TRANSPORT IN THE LOWER YAMPA RIVER, NORTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
J. G. Elliott, J. E. Kircher, and P. Von Guerard.
Available from the OFSS, USGS, Box, 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 84-4141, 1984. 44 p, 9 Fig, 14 Tab, 29 Ref.

Descriptors: *Sediment transport, Annual streamflow, Flow duration, *Annual sediment load, *Sediment budget, *Colorado, Yampa River, Deerlodge Park, Yampa Canyon, Dinosaur National Monument.

Discharge measurements and sediment samples were taken at streamflow-gaging station 09260050 Yampa River at Deerlodge Park in 1982 and 1983 to determine the annual sediment supply to the Yampa Canyon in Dinosaur National Monument. Forty-three years of discharge records at two tributary sites were combined to determine the historic discharge of the Yampa River at Deerlodge Park. A mean annual hydrograph and flow-duration curve were derived from these data. Sediment-transport equations were derived for total sediment discharge, suspended-sediment discharge, bedload dischagre, and the discharge of sediment in several particle-sizes. Annual sediment discharge were determined by the flow-duration, sediment-rating-curve method and indicated annual total sediment discharge was approximately 2.0 million tons per year of which 0.8 million tons per year was sand-sized material. Bedload was almost entirely sand, and annual bedload discharge was 0.1 million tons per year. Development of water resources in the Yampa River basin could effect the geomorphic character of the Yampa River at Deerlodge Park and the Yampa Canyon. Several scenarios of altered streamflow frequency distribution, reduced streamflow volume, and reduced sediment supply are examined to estimate the effect on the sediment budget at Deerlodge Park. (USGS)
W85-02045

BOTTOM DYNAMICS IN LAKES,
National Swedish Environment Protection Board, Uppsala (Sweden). Water Quality Lab.
L. Hakanson.
Hydrobiologia, Vol. 91, p 9-22, July, 1982. 11 Fig, 2 Tab, 39 Ref.

Descriptors: *Lake sediments, *Bottom sediments, *Bottom sampling, Sediments, Erosion, Entrainment, Wind-driven currents.

A proper understanding of the bottom dynamic conditions (erosion, transportation, accumulation) in lakes is essential in most sedimentological contexts. Fine cohesive materials generally dominate the open water areas, whereas coarser deposits (sand, gravel) dominate shallow regions where erosion and transportation of fine materials prevail. At present, there is no physical model available which describes the linkage between the energy content of the water-mass and the capacity for sediment entrainment in open water areas. Water-mass energy depends on, e.g. wind direction, duration, velocity, fetch, and the presence of a thermocline. Entrainment depends on, e.g. density, compaction, water and organic content of the sediments and the number and type of bottom fauna. Four different methods are used to determine bottom dynamics, two are site typical and two lake typical. Site and lake typical methods each include one method based on collected field data and one based on theoretical data. One method, the cone apparatus, is presented for the first time. It consists of two cones, one of which has a narrow angle and the other a wide angle, which are zero adjusted at the sediment surface before being released to penetrate the sediments. The differential cone penetration, refered to as the penetration ratio, is used to indicate the degree of surficial sediment compaction. This simple, inexpensive instrument provides quantitative data on physical sediment characteristics which may be related to bottom dynamic conditions. (Author's abstract)
W85-02054

ENTRAINMENT, DEPOSITION, AND TRANSPORT OF FINE-GRAINED SEDIMENTS IN LAKES,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
W. Lick.
Hydrobiologia, Vol. 91, p 31-40, July, 1982. 12 Fig, 1 Ref.

Descriptors: *Entrainment, *Sedimentation, *Lake Erie, Great Lakes, Deposition, Sediment transport, Turbidity, Vertical distribution, Benthic environment.

Recent work on the settling, diffusion, entrainment, and deposition of fine grained sediments in freshwater is reviewed and synthesized. Particular attention is given to the dependence of these processes on sediment properties such as particle size. The application of this knowledge to the analysis and numerical modeling of sediment transport is also discussed. Much of the work is concerned with the Great Lakes, and more specifically, with the Western Basin of Lake Erie. Entrainment experiments have been carried out which demonstrate that entrainment depends on at least the turbulent stress at the sediment-water interface; water content of the deposited sediments; composition of the deposited sediments, including mineralogy, particle-size distribution and organic content; vertical distribution of sediment properties, manner of deposition of sediments; and activity of benthic organisms and bacteria. Particle size variation is a significant factor and because of this the amount of material available for entrainment at a particular stress is finite. The available sediments participate continuously in the entrainment and deposition cycle. Some numerical modeling of sediment transport has been done. Problems arise because sediment properties are highly variable spatially and also with time. Additional research is needed to determine particle collision rates, the probability that particles will adhere after collision, the causes of disaggregation, and the rates at which particles disaggreagate. (Baker-IVI)
W85-02055

PHYSICAL AND GEOCHEMICAL CHARACTERISTICS OF SUSPENDED SOLIDS, WILTON CREEK, ONTARIO,
National Water Research Inst., Winnipeg (Manitoba).
For primary bibliographic entry see Field 2H.
W85-02056

SEDIMENTATION IN FLUVIAL AND LACUSTRINE ENVIRONMENTS,
Ottawa Univ. (Ontario). Dept. of Geology.
B. R. Rust.
Hydrobiologia, Vol. 91, p 59-70, July, 1982. 10 Fig, 1 Tab, 60 Ref.

Descriptors: *Lake sediments, *Stream sediments, *Sedimentation, *Ottawa River, Channeling, Clastic deposition, Mercury, Path of pollutants, Lakes.

Sedimentation in rivers is dominated by a complex set of physical processes associated with the unidirectional flow of water. Variations in these processes give rise to different fluvial channel types, whose character can commonly be recognized in the ancient record. Chemical and biological processes are comparatively unimportant in fluvial sedimentation. In contrast, physical, chemical or biological processes can each dominate sedimentation in lakes. Physical (clastic) deposition dominates in high-latitude and mountain lakes (in which chemical and biological activity are low), and in lakes with high relief of the drainage basin and lake floor. Its variety reflects a range of processes influenced by river inflow, wave and current action, thermal and density effects. Economic benefits from the study of lake and river sedimentation include both resource and environmental aspects. An example is given of a mercury pollution study in the Ottawa River, Ottawa. It shows that return to background levels can take place within a relatively short interval after cessation of pollutant input. (Author's abstract)
W85-02057

COMPARISON OF SEDIMENT ENERGY-TEXTURE RELATIONSHIPS IN MARINE AND LACUSTRINE ENVIRONMENTS,
Canada Centre for Inland Waters, Burlington (Ontario).
P. G. Sly, R. L. Thomas, and B. R. Pelletier.
Hydrobiologia, Vol. 91, p 71-84, July, 1982. 11 Fig, 1 Tab, 37 Ref.

Descriptors: *Sediments, *Lake sediments, *Marine sediments, *Sediment erosion, Sedimentation, Silt, Clay, Erosion.

Sediments in the marine environment are generally subject to higher energy levels than those of lake systems, and lakes are virtually unaffected by tidal range which modifies beach structures formed in response to wave effects. However, despite different energy levels, the textural characteristics of both marine and lacustrine sediments are very similar. The main difference between marine and lacustrine facies is the depth range over which characteristics remain consistent. In lakes, depth limitation may influence the development of surface waves and restrict textural distributions. Simple textural relationships can be used to describe comparable marine and lacustrine sedimentary conditions. Sediments which have been altered by post-depositional erosion, such as lag deposits, or by ice-drop or wind blown settlement, show comparable textural modifications. The settlement of silt and clay particulates, in the marine environment and lakes, may differ slightly because of the chemical differences between salt and fresh water. (Author's abstract)
W85-02058

LAND USE EFFECTS ON SEDIMENT YIELD AND QUALITY,
British Columbia Univ., Vancouver. Dept. of Geography.
For primary bibliographic entry see Field 6G.
W85-02060

BASIC CONCEPTS AND ASSOCIATED STATISTICAL METHODOLOGY IN THE GEOCHEMICAL STUDY OF LAKE SEDIMENTS,
Geneva Univ. (Switzerland). Inst. F.-A. Forel.
J. M. Jaquet, E. Davaud, F. Rapin, and J. P. Vernet.
Hydrobiologica, Vol. 91, p. 139-146, July, 1982. 4 Fig, 1 Tab, 23 Ref.

Descriptors: *Lake sediments, *Sedimentation, *Lac Leman, *Switzerland, Lakes, Sediment transport, Geochemistry, Particle size, Calcium carbonate.

A few of the fundamental concepts that underlie geochemical investigations are discussed on the basis of data collected in Lac Leman, Switzerland. Specifics include the carrier substance, the natural background level, the grain-size effects and the areal variability of geochemical associations. The key role played by the statisical methods in expressing, testing, and refining these concepts is emphasized. Ordination diagrams clearly suggest the existence of several carrier substances in Lac Leman, some of them unsuspected. The need for reliable background levels in environmental geochemistry can be met by expressing them as a simple function of a major sediment constituent, calcium carbonate, in the case of Lac Leman. The use of the complete grain-size spectrum, instead of its moments only, leads to a significant refinement of the notion of grain-size effect. It is now possible to know, by means of a simple correlation analysis, in what size fractions major and minor constituents are most likely to be found. A combination of R- and Q-mode analysis was instrumental in demonstrating the variability of geochemical associations within the lake. Relationships between carrier substances and trace metals can be computed facies by facies, thus avoiding the adverse effect, on the correlation coefficients, of lumping together distinct sub-populations. (Baker-IVI)
W85-02064

CARBON FLOW ACROSS THE SEDIMENT-WATER INTERFACE IN LAKE VECHTEN, THE NETHERLANDS,
Limnologisch Inst., Nieuwersluis (Netherlands).
For primary bibliographic entry see Field 2H.
W85-02066

LOADING CONCENTRATION MODELS FOR PHOSPHATE IN SHALLOW LAKES,
Centre d'Ecologie de Camargue (France).
For primary bibliographic entry see Field 2H.
W85-02067

DIURNAL VARIATION IN THE OXYGEN UPTAKE OF RIVER SEDIMENTS IN VITRO BY USE OF CONTINUOUS FLOW-THROUGH SYSTEMS,
Copenhagen Univ., Hilleroed (Denmark). Det Ferskvands-Biologiske Lab.
For primary bibliographic entry see Field 2E.
W85-02069

MASS BALANCE MODELS OF PHOSPHORUS IN SEDIMENTS AND WATER,
Canada Centre for Inland Waters, Burlington (Ontario).
D. C. L. Lam, W. M. Schertzer, and A. S. Fraser.
Hydrobiologia, Vol. 91, p 217-225, July, 1982. 8 Fig, 6 Ref.

Descriptors: *Sediment-water interfaces, *Phosphorus, *Model studies, Mass balance models, Sediment transport, Lakes, Lake Erie.

A hierarchy of models is examined and the advantages and disadvantages of increasing their spatial complexity is determined as it relates to mass balance of phosphorus in sediments and water. In addition, the relationships of the results derived from these models are explained with the view that the results from models of progressive complexity are interdependent and can be synthesized into a more comprehensive description of the actual environment than any particular one of them can. As an example, the total phosphorus concentrations in the Western, Central and Eastern Basins of Lake Erie are simulated with the three-box, six-box and multi-box mass-balance models. The emphasis, here, is placed on the effect of thermal stratification and interbasin transport on the settling and sediment return of total phosphorus as the spatial complexity of the model increases. While it is understood that there are several forms or compartments of phosphorus which contribute differently to the total concentration, there are uncertainties associated with the kinetics between the different forms. (Baker-IVI)
W85-02071

ANALYSIS OF TOTAL PHOSPHORUS TRANSPORT IN RIVER SYSTEMS,
West Virginia Univ., Morgantown.
For primary bibliographic entry see Field 2E.
W85-02074

MICROBIAL METABOLISM IN SURFACE SEDIMENTS AND ITS ROLE IN THE IMMOBILIZATION OF PHOSPHORUS IN OLIGOTROPHIC LAKE SEDIMENTS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
C. Doremus, and L. S. Clesceri.
Hydrobiologia, Vol. 91, p 261-268, July, 1982. 5 Fig, 2 Tab, 30 Ref.

Descriptors: *Lake sediments, *Oligotrophic lakes, *Phosphorus, *Lake George, *New York, Microorganisms, Metabolism, Organic matter, Detritus, Eutrophication, Anaerobic conditions.

Rapid microbial metabolism and a large phosphorus uptake potential were noted in surface sediments of Lake George, New York. This sediment also exhibited a phosphorus limited condition and a large reservoir of inorganic phosphorus associated with humic substances. These observations suggest that the empirically observed phosphorus retention in oligotrophic lake sediments may be promoted by a rapid cycling of phosphorus between microflora and its associated organic matter. A conceptual model is presented describing phosphorus interactions in surface profundal sediments. Sedimenting organic P settles onto the oxidized sediment where it cycles rapidly within the microbial-detrital complex. Detritovores mobilize phosphorus through excretion and burrow pumping. A significant quantity of phosphate-phosphorus is adsorbed onto the biodetrital complex. This adsorbed pool is part of the biodetrital P buffering capacity because it participates as an intermediary between microbial biomass and inorganic phosphorus. Non-adsorbed inorganic phosphorus probably becomes sequestered

in ferric hydroxide compounds. Biodetritus in the reduced sediments tends to be less microbially active and less efficient due to anaerobic metabolism. This phenomenon and the lack of an iron sequestering mechanism causes phosphate to accumulate in deep sediments and diffuse upward. As a lake proceeds along the eutrophication continuum, phosphorus release in anoxic eutrophic sediments may be attributed to phosphorus inputs to the sediments in quantities that are greater than the buffering capacity of the biodetritus. The shift from an aerobic to an anaerobic metabolism in surface sedimentary biodetritus may also aid in the loss of retentive efficiency in eutrophic lake sediments. (Baker-IVI)
W85-02076

PHOSPHATE ADSORPTION KINETICS OF RESUSPENDED SEDIMENTS IN A SHALLOW LAKE, NEUSIEDLERSEE, AUSTRIA,
Vienna Univ. (Austria). Limnologische Lehrkanzel.
For primary bibliographic entry see Field 2H.
W85-02079

PARTICLE SIZE DISTRIBUTION AND CHEMICAL PARAMETERS OF THE SEDIMENTS OF A SHALLOW TURBID IMPOUNDMENT,
Orange Free State Univ., Bloemfontein (South Africa). Dept. of Botany.
For primary bibliographic entry see Field 2H.
W85-02082

INTERACTION BETWEEN INTERSTITIAL WATER AND SEDIMENT IN TWO CORES OF LAC LEMAN, SWITZERLAND,
Geneva Univ. (Switzerland). Dept. of Inorganic, Analytical and Applied Chemistry.
For primary bibliographic entry see Field 2H.
W85-02084

VERTICAL STRATIFICATION IN SEDIMENTS FROM A YOUNG OLIGOTROPHIC SOUTH AFRICAN IMPOUNDMENT: IMPLICATIONS IN PHOSPHORUS CYCLING,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Botany.
For primary bibliographic entry see Field 2H.
W85-02086

TRANSPORT OF IRON AND MANGANESE IN RELATION TO THE SHAPES OF THEIR CONCENTRATION-DEPTH PROFILES,
Freshwater Biological Association, Windermere (England).
For primary bibliographic entry see Field 2K.
W85-02090

DEEPWATER SEDIMENTS AND TROPHIC CONDITIONS IN FLORIDA LAKES,
Florida State Museum, Gainesville.
For primary bibliographic entry see Field 2H.
W85-02099

SEDIMENTATION RATES IN A SWISS-ITALIAN LAKE MEASURED WITH SEDIMENT TRAPS,
Commission of the European Communities, Ispra (Italy). Joint Research Centre.
G. Premazzi, and G. Marengo.
Hydrobiologia, Vol. 92, p 603-610, July, 1982. 4 Fig, 5 Tab, 26 Ref.

Descriptors: *Tripton, *Sedimentation, *Lake Lugano, *Italy, *Switzerland, Mineralization, Stratification, Phosphorus, Nitrogen, Organic carbon, Diffusion, Decomposition, Lake sediments, Nutrients.

Tripton sedimentation was investigated in the eutrophic Lake Lugano (Ponte Tresa basin) from October 1979 to October 1980. The annual amount of tripton collected was 748 g/sq m/y. Phosphorus, nitrogen and organic carbon fluxes into the hypolimnion were estimated to be 1.9, 16.2 and 121 g/sq m/y respectively. Mineralization rates into the trophogenic layer varied from 11% to 19% per day during summer stratification. The regeneration processes contribute about 60% of the calculated P deficit in the epilimnion. The tripton is decomposed mostly in the metalimnion, out of the euphotic zone; from here the phosphorus is carried back to the overlying waters by diffusion processes. (Author's abstract)
W85-02100

EFFECTS OF SEDIMENTATION ON THE STORAGE CAPACITY OF THE HIGH ASWAN DAM RESERVOIR,
Ministry of Irrigation, Cairo (Egypt). Research Inst. of High Dam Side Effects.
For primary bibliographic entry see Field 4A.
W85-02101

CLIMATIC AND ANTHROPOGENIC EFFECTS ON THE SEDIMENTATION AND GEOCHEMISTRY OF LAKES BOURGET, ANNECY AND LEMAN,
Geneva Univ. (Switzerland). Inst. F.-A. Forel.
For primary bibliographic entry see Field 2H.
W85-02102

STANDARDIZATION OF METHODS OF ANALYSIS FOR HEAVY METALS IN SEDIMENTS,
Institute for Soil Fertility, Groningen (Netherlands).
For primary bibliographic entry see Field 5A.
W85-02104

SEDIMENT CONCENTRATIONS FROM INTENSIVELY PREPARED WETLAND SITES,
Clemson Univ., SC. Belle W. Baruch Forest Science Inst.
For primary bibliographic entry see Field 4C.
W85-02112

OBJECTIVE IDENTIFICATION OF POOLS AND RIFFLES,
State Univ. of New York at Buffalo. Dept. of Geography.
For primary bibliographic entry see Field 2E.
W85-02159

2K. Chemical Processes

NITROGEN AND PHOSPHORUS IN THE NGONGOTAHA STREAM,
Ministry of Works and Development, Hamilton (New Zealand). Water and Soil Science Centre.
For primary bibliographic entry see Field 5B.
W85-01635

VEGETATION AND WATER CHEMISTRY OF FOUR OLIGOTROPHIC BASIN MIRES IN NORTHWESTERN ONTARIO,
Alberta Univ., Edmonton. Dept. of Botany.
For primary bibliographic entry see Field 2H.
W85-01648

STATISTICAL ANALYSIS AND EVALUATION OF WATER-QUALITY DATA FOR SELECTED STREAMS IN THE COAL AREA OF EAST-CENTRAL MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 5B.
W85-01770

ORIGINS AND DISTRIBUTION OF SALINE GROUND WATERS IN THE FLORIDAN AQUIFER IN COASTAL SOUTHWEST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
W. C. Steinkampf.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, Price: $4.75 in paper copy, $3.50 in microfiche. USGS Water Resources Investigations Report 82-4052, 1982. 34 p, 13 Fig, 7 Tab, 36 Ref.

Descriptors: *Geochemistry, *Water quality, *Groundwater, *Saline water, Aquifers, Carbonate rocks, Diagenesis, Distribution, Salinity, *Florida, Floridan aquifer, Charlotte County, De Soto County, Lee County, Manatee County, Sarasota County.

Twenty-three ground-water samples from the Floridan aquifer in coastal southwest Florida show that water quality deteriorates to the south and west. The waters grade from a fresh calcium magnesium bicarbonate sulfate type to a very saline sodium magnesium chloride type downgradient. Bromide-chloride and specific conductance ratios indicate that dilution of marine-like ground water is a signigicant mechanism in the evolution of the different water types found. Calcium, magnesium, and bicarbonate concentrations occur within a relatively narrow range and are primarily a function of mineral equilibria. Magnesium and strontium concentration distributions suggest several mineral-water interactions, including aragonite inversion, incongruent solution of magnesium calcite to a lower magnesian form, and dedolomitization. Sulfate concentrations increase downgradient and evince gypsum-anhydrite solution, particularly in the fresher waters. The extent to which each factor affects dissolved specie concentrations is a function of the location of the water in the flow system. (USGS)
W85-01778

HYDROGEOCHEMICAL INVESTIGATION OF THERMAL SPRINGS IN THE BLACK CANYON-HOOVER DAM AREA, NEVADA AND ARIZONA,
Nevada Univ. System, Reno. Water Resources Center.
W. A. McKay, and D. E. Zimmerman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202472, Price codes: A04 in paper copy, A01 in microfiche. Publication 41092, November 1983. 40 p, 10 Fig, 2 Tab, 36 Ref. Project No. OWRT A-100-NEV(1), Contract/Grant No. 14-34-0001-2130.

Descriptors: *Thermal water, *Colorado River, *Stable isotopes, *Chemical analysis, *Thermal springs, Geochemistry, *Tritium, Chemical geothermometry, Nevada, Arizona, Black Canyon.

An estimated 80 liters/sec. of spring flow discharges from both sides of the Colorado River in Black Canyon, Nevada, and Arizona. The springs issue primarily from the highly faulted and fractured volcanic rocks which are exposed throughout the canyon from Hoover Dam to 9.5 kilometers downstream. Chemical analysis of the spring waters, including environmental isotope and tritium results, indicate a variety of possible origins. Possible source waters include, in order of estimated importance, recirculated Lake Mead water, regional groundwaters from the north, west, and east, deep circulating hydrothermal fluids, and locally recharged groundwaters. Observed surface temperatures range from 24 C to 62 C. Total dissolved solids values range from 500 mg/l to 3600 mg/l. Tritium concentrations range from < 5 T.U. to 116 T.U. While thermodynamic calculations indicate oversaturation of these waters with respect to several silicate and carbonate minerals, the occasional absence of secondary mineral deposits suggests a potentially young system.
W85-01804

SHORT-TERM CHANGES IN THE BASE NEUTRALIZING CAPACITY OF AN ACID ADIRONDACK LAKE, NEW YORK,
Syracuse Univ., NY. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W85-01917

DISTRIBUTION OF SELECTED CHEMICAL CONSTITUENTS IN WATER FROM THE FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT,
Geological Survey, Tallahassee, FL. Water Resources Div.

For primary bibliographic entry see Field 7C.
W85-01928

GROUND WATER IN THE REDDING BASIN, SHASTA AND TEHAMA COUNTIES, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W85-01945

SINGLET OXYGEN IN SURFACE WATERS - PART I: FURFURYL ALCOHOL AS A TRAPPING AGENT,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
W. R. Haag, J. Hoigne, E. Gassman, and A. M. Braun.
Chemosphere, Vol. 13, No. 5/6, p 631-640, 1984. 5 Fig, 29 Ref. Swiss National Science Foundation Project 2.027-0.81.

Descriptors: *Oxygen, *Trapping, *Furfuryl alcohol, *Natural waters, Water analysis, Photochemical reactions, Oxidants, Oxidation-reduction potential, Chemical reactions.

A comparison was made between the product distributions obtained with Black Lake humic acid and rose bengal as a test of the intermediacy of singlet oxygen in humic acid photosensitized oxygenation of furfuryl alcohol (FFA). The HPLC analyses showed that peaks due to phosphate and humic acid were too small to interfere, and that the product distributions were the same both in the Black Lake humic acid and the rose bengal sensitized systems. These facts, together with the observations that no oxygen consumption occurred in the irradiated solutions in the absence of either FFA or sensitizer, constitutes sizeable evidence for the intermediacy of singlet oxygen in these reactions. Singlet oxygen concentrations in natural waters exposed to sunlight are most easily determined by adding a low concentration of acceptor and following its first order rate of consumption. FFA is recommended as a highly soluble, efficient trapping agent for singlet oxygen determinations in natural waters. (Baker-IVI)
W85-01964

SINGLET OXYGEN IN SURFACE WATERS - PART II: QUANTUM YIELDS OF ITS PRODUCTION BY SOME NATURAL HUMIC MATERIALS AS A FUNCTION OF WAVELENGTH,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
W. R. Haag, J. Hoigne, E. Gassman, and A. M. Braun.
Chemosphere, Vol. 13, No. 5/6, p 641-650, 1984. 5 Fig, 2 Tab, 12 Ref. Swiss National Science Foundation Project 2.027-0.81.

Descriptors: *Oxygen, *Water analysis, *Natural waters, *Dissolved solids, Chemical reactions, Photochemical reactions.

Quantum yields of singlet oxygen production by natural aquatic organic matter decrease with increasing wavelength, indicating that calculations assuming a constant quantum yield measured at a singlet short wavelength can overestimate the steady state singlet oxygen concentrations in sunlit surface waters by more than a factor of 2. Isolated humic acids exhibit peaks in singlet oxygen production at longer wavelengths than natural dissolved organic materials suggesting that compounds other than humics are also responsible for singlet oxygen production in natural waters. Various methods of measurement suggest that singlet oxygen concentrations in the upper few centimeters of natural surface waters under noon, spring or fall Swiss sunlight lie in the range of 1-3 x 10 to the minus 14 M per mg/L dissolved organic material. Half-lives of reactive organics are a few days to a few hours. Reaction with singlet oxygen will be an important degradation pathway for relatively few micropollutants. (Baker-IVI)
W85-01965

OCCURRENCE, QUALITY, AND USE OF GROUND WATER IN ORCAS, SAN JUAN, LOPEZ, AND SHAW ISLANDS, SAN JUAN COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-02043

ALGAL-AVAILABILITY OF PARTICULATE PHOSPHORUS FROM DIFFUSE AND POINT SOURCES IN THE LOWER GREAT LAKES BASIN,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
T. C. Young, and J. V. DePinto.
Hydrobiologia, Vol. 91, p 111-119, July, 1982. 6 Fig, 5 Tab, 24 Ref. EPA grant R-806817-01.

Descriptors: *Phosphorus, *Great Lakes, *Algal growth, *Algae, Phytoplankton, Productivity, Aquatic productivity, Nutrients, Bioassay, Wastewater treatment.

Control of phytoplankton production in the Great Lakes can be achieved most efficiently by limiting inputs of biologically available P. We report the results of studies performed to characterize the chemical forms and availability of particulate P in wastewater and tributaries which enter the lower Lakes, the eroding bluffs which border Lake Erie, and bottom samples from the near-shore of western Lake Erie. Rates of release of available P were estimated from a simple first-order model of the process, as observed during algal bioassays. Available P in wastewater samples, as a fraction of total particulate P, was affected minimally by wastewater treatment, including chemical precipitation and filtration; it correlated well with levels of total particulate P. Available particulate P levels in fluvial suspended sediments showed regional uniformity, but appeared to be strongly dependent on levels of both NaOH-P and CDB-P. Rates of release of available P decreased during wastewater treatment to values which were similar in magnitude to those observed for fluvial sediments. Release rates, however, were not related to any of the particulate P fractions which were measured. Analysis of the bluff and bottom samples indicated that P availability in the former was negligible, but the latter contained levels which approached those of wastewater particulates, though available P was released from the bottom sediments at relatively low rates. (Author's abstracts)
W85-02061

TRANSPORT OF IRON AND MANGANESE IN RELATION TO THE SHAPES OF THEIR CONCENTRATION-DEPTH PROFILES,
Freshwater Biological Association, Windermere (England).
W. Davison.
Hydrobiologia, Vol. 92, p 463-471, July, 1982. 5 Fig, 31 Ref.

Descriptors: *Iron, *Manganese, *Sediments, *Transport, *Model studies, Redox boundary, Concentration gradient, Oxidation, Chemical reduction, Interstitial water.

A model is presented which describes the transport of iron and manganese in the vicinity of a redox boundary. It is based on input of a particulate component, to form a point source, from which soluble species diffuse along a concentration gradient. The shapes of concentration-depth profiles in marine and freshwater sediments and water columns are reviewed and discussed in terms of the model. Transport, either entirely within a water column or within the sediment, may be simply treated because the rate of vertical transport can be regarded as constant. The discontinuity in the rate of vertical transport which occurs at the sediment-water interface can provide a complicated example of the model, especially when it coincides with the redox boundary. Authigenic mineral formation processes can modify the model, sometimes to such an extent that it becomes invalid. This particulary true for soluble iron profiles on organically rich marine sediments. Sampling interval is critical to the resultant profile shape and must be relevant to the particular environment, e.g. meters in water columns and millimeters in sediments. The differences in the rate of reduction and oxidation of iron and manganese tend to modify both the position of the profile with respect to the redox-cline and its stage of development in a seasonally anoxic system. It is these factors which determine why most of the iron which reaches a sediment is permanently incorporated whereas manganese is re-released. This mechanism determines the average ratio of iron to manganese in sedimentary rocks. The development of peaked profile shapes in water columns implies that under certain conditions dissolved iron and manganese may be transported from the waters of the sediment. (Author's abstract)
W85-02090

INFLUENCE OF SIMULATED GROUNDWATER-MOVEMENT ON THE PHOSPHORUS RELEASE FROM SEDIMENTS, AS MEASURED IN A CONTINUOUS FLOW SYSTEM,
Amsterdam Univ. (Netherlands). Lab. voor Microbiologie.
For primary bibliographic entry see Field 2F.
W85-02094

MOTION OF TWO COMPRESSIBLE FLUIDS WITH INTERFACE IN A POROUS RESERVOIR,
Department of Scientific and Industrial Research, Wellington (New Zealand). Applied Mathematics Div.
For primary bibliographic entry see Field 2F.
W85-02154

2L. Estuaries

SOILS OF SWAMPS IN THE APALACHICOLA, FLORIDA, ESTUARY,
C. L. Coultas.
Florida Scientist, Vol. 47, No, 2, p 98-107, 1984. 3 Fig, 3 Tab, 15 Ref.

Descriptors: *Apalachicola estuary, *Florida, *Swamps, *Soil types, Wetlands, Estuaries, Sulfaquents, Sulfihemists, Fluvaquents, Acidic soils, Salinity, Conductivity, Clays, Soil classification.

Until recently, forested wetlands in Florida were classified as miscellaneous land types or as broadly defined soil series. Selected soils in swamps of the Apalachicola, Florida estuary were sampled and analyzed. Three great groups, Sulfihemists, Sulfaquents, and Fluvaquents were found. These soils were wet, moderately acid, high in clay content, and low in salinity. Conductivity values increased from the surface downward because the surface tends to be frequently flushed with rain and river waters resulting in a dilution of salts. Kaolinite, vermiculite, quartz, and mica were the principal clay-sized minerals. Decisions concerning agronomic utilization of these soils should be carefully made because of their high potential acidity, low-bearing strength, and frequent flooding. (Collier-IVI)
W85-01641

MODELING ESTUARINE NUTRIENT GEOCHEMISTRY IN A SIMPLE SYSTEM,
Florida State Univ., Tallahassee. Dept. of Oceanography.
L. W. Kaul, and P. N. Froelich, Jr.
Geochimica et Cosmochimica Acta, Vol. 48, No. 7, p 1417-1433, July, 1984. 13 Fig, 4 Tab, 87 Ref.

Descriptors: *Cycling nutrients, *Estuarine environment, *Geochemistry, *Model Studies, *Nutrients, *Ochlockonee Bay, *Florida, Primary production, Phosphorus, Nitrogen, Silica, Phosphates, Nutrient removal, Estuaries.

A model of estuarine nutrient fluxes through a simple estuary over a one-year period demonstrates that estuaries are geochemical transformers that enchance the reactive fluvial phosphate flux to the oceans (by activation of fluvial particulates) and pass the fluvial silica flux unaltered. The model

was applied to 39 nutrient (P, N, Si) profiles collected over a 14-month period in the pristine river/estuary, Ochlockonee Bay, Florida. Each profile is deconvolved into three component functions: linear mixing (conservative), first-order removal (biological productivity), and parabolic input (regeneration). After correction for temporal variations in the fluvial end-members, the model provides quantitative estimates of total estuarine primary production, net regeneration, and subsequent fluxes to the ocean over a year-long period. The modeled data set is internally self-consistent: virtually all the phosphorus and silica removed during primary production is quickly returned to the water column by regeneration and enters the ocean. One-third of the fluvial reactive-P enters the estuary as particles whose phosphate is released after deposition in estuarine sediments. About 20% of the dissolved fluvial silica flux is removed biologically; all of this biogenic silica dissolves in the estuary and enters the ocean. N cannot be mass balanced, probably because it enters and escapes the bay in unmeasured forms (as NH4 or via denitrification to N2 and N2O). In the Ochlockonee, biological productivity removes nutrients in the ratios N:P approximately = 9:1 and Si:P approximately = 20:1. The Bay is an inefficient nutrient recycler due to its small size and rapid washout rates. (Collier-IVI)
W85-01702

CHANGES IN THE FISH FAUNA OF THE FORMER GREVELINGEN ESTUARY, BEFORE AND AFTER THE CLOSURE IN 1971,
For primary bibliographic entry see Field 6G.
W85-01765

TRANSPORT OF DISSOLVED ORGANIC CARBON THROUGH A MAJOR CREEK OF THE NORTH INLET ECOSYSTEM,
Texas Univ. at Arlington. Dept. of Biology.
T. H. Chrzanowski, L. H. Stevenson, and J. D. Spurrier.
Marine Ecology - Progress Series, Vol. 13, No. 2/3, p 167-174, August, 1983. 6 Fig, 5 Tab, 26 Ref. NSF grant DEB 7683010.

Descriptors: *Organic carbon, *Dissolved solids, *Town Creek, *South Carolina, Solute transport, Marshes, Tidal waters, Spartina, Nutrients.

Sampling was at a transect across Town Creek in the North Inlet Ecosystem, South Carolina. The creek drains much of the northern section of a 3200 ha salt marsh and forms a large section of the marsh inlet. Samples were collected every 1.5 h for 50 consecutive hours during neap tides (4 tidal cycles) and 50 consecutive hours during corresponding spring tides of each season. Dissolved organic carbon (DOC) concentrations were variable, ranging from 0.9 to 13.0 g/cu m of water with as much as 2.5 g/cu m of water variation during a 1.5 h period. There was no apparent trend toward higher DOC concentrations during spring tides. DOC was exported from the marsh during each sampling period. Net transports ranged from approximately 5 to 480 g DOC/s. Annual budgets revealed a DOC export as high as 7.5 +/- 1.8 x 10 to the 9th g C/yr corresponding to 416 g DOC/sq m/yr. Net exports of DOC and TOC (total organic carbon) correspond to 91% and 117% of the Spartina production, which is not reasonable. Either Spartina may not be the most important input of DOC to the system, or the sampling scheme used in this study generated transport estimates that could not be reliably extended to annual budgets. (Moore-IVI)
W85-01766

SEDIMENTATION OF ORGANIC AND INORGANIC PARTICULATE MATERIAL IN LINDASPOLLENE, A STRATIFIED, LAND-LOCKED FJORD IN WESTERN NORWAY,
Bergen Univ. (Norway). Inst. of Marine Biology.
P. Wassmann.
Marine Ecology - Progress Series, Vol. 13, No. 2/3, p 237-248, August, 1983. 5 Fig, 5 Tab, 77 Ref.

Descriptors: *Particulate matter, *Lindaspollene, *Norway, *Sedimentation, Fjords, Organic matter, Organic carbon, Mineralization, Organic nitrogen, Diatoms, Zooplankton.

Sedimentation of particulate material to the bottom (90 m) was measured in Lindaspollene, a land-locked, highly stratified, west Norwegian fjord, receiving fresh water from a small glacier free watershed. Five cylindrical sediment traps positioned at 10, 20, 40, 70, and 85 m below the surface were exposed from April to November. Organic material comprised 40 to 60% of the sedimented matter. Sedimentation rates of particulate inorganic material (PIM) and particulate organic carbon (POC) decreased from 229 and 111 at 20 m to 71 and 22 g/sq m/yr, respectively, in the deeper water. Possible reasons for the low sedimentation in the stagnant water below 40 m are high mineralization rates in the upper 40 m and the lack of resuspension in the water below. Three pulses of POC and PON (particulate organic nitrogen) reached the bottom related to phytoplankton blooms in April and May. The pulse in April was the largest and the sedimented material consisted of unidentified aggregates, diatoms and some few fecal pellets. Few recognizable structures were found in the samples below 20 m except in April. This might indicate a low zooplankton grazing efficiency in April, but a high efficiency during the rest of the investigation period. (Author's abstract)
W85-01767

FLUXES OF HEAVY METALS IN DELAWARE RIVER FRESHWATER TIDAL WETLANDS,
Rider Coll., Lawrenceville, NJ. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W85-01805

RECENT VERTICAL ACCRETION RATES AT BLACKWATER WILDLIFE REFUGE,
Maryland Univ., College Park. Dept. of Geography.
M. S. Keaeney, S. P. Leatherman, and G. T. F. Wong.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-190107, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center Technical Report No. 78, August 1983. 43 p, 8 Fig, 3 Tab, 17 Ref, 2 Append. Project No. OWRT A-064-MD(1), Contract/Grant No. 14-34-0001-2122.

Descriptors: *Accretion, Tidal marshes, Sedimentation rates, Lead radioisotopes, Organic matter, Sea level rise, Peat, Density, *Maryland, Blackwater National Wildlife Refuge.

Vertical accretion rates and sediment composition analyses were determined for Scirpus olneyi-dominated marshes near Shorter's Wharf Road in the Blackwater National Wildlife Refuge. Pb210 activity profiles of two cores from backmarsh sites suggest that long-term marsh accretion rates (ranging from 1.7 mm/yr to 3.6 mm/yr have not kept up with the local rate of sea level rise of 3.87 mm/yr. Organic carbon and bulk density analyses demonstrated that accumulation of organic matter is the primary accretionary mechanism in these marshes. However, marsh loss is probably not so much a function of inorganic sediment starvation, but the result of the slow burial and decay of older peat sediments.
W85-01809

RIVER ELBE: PROCESSES AFFECTING THE BEHAVIOUR OF METALS AND ORGANOCHLORINES DURING ESTUARINE MIXING,
Nederlands Inst. voor Onderzoek der Zee, Texel.
For primary bibliographic entry see Field 5B.
W85-01836

RIVER WESER PROCESSES AFFECTING THE BEHAVIOUR OF METALS AND ORGANOCHLORINES DURING ESTUARINE MIXING,
Nederlands Inst. voor Onderzoek der Zee, Texel.
For primary bibliographic entry see Field 5B.
W85-01837

ONE-DIMENSIONAL MIXING AND FLUSHING MODEL OF THE EMS-DOLLARD ESTUARY: CALCULATION OF TIME SCALES AT DIFFERENT RIVER DISCHARGES,
Nederlands Inst. voor Onderzoek der Zee, Texel.
W. Helder, and P. Ruardij.
Netherlands Journal of Sea Research, Vol. 15, No. 3/4, p 293-312, December, 1982. 12 Fig, 2 Tab, 19 Ref.

Descriptors: *Estuaries, *Ems-Dollard Estuary, *Mixing, *Flushing, River flow, Tidal effects, Model studies, Salinity.

The Ems-Dollard estuary is situated at the Dutch-German border, and is part of the Wadden Sea, characterized by channels and extensive tidal flats. Of the total surface area 40 to 50% consists of tidal flats; in the Dollard, 80%. The tidal prism of the estuary as a whole is about 1100 million cubic meters. The tide is semidiurnal and mean tidal amplitude about 3 m. Starting from longitudinal salinity distributions over the years 1970 to 1977 it was shown that the flushing time decreases with increasing river flow. At average discharge the flushing time of Ems water was found to be 38 days and that of Westerwoldse Aa water within the Dollard 14 days. By segmentation of the Ems-Dollard estuary in 17 compartments a box model was constructed that can be used to predict the dispersion of water and dissolved constituents. Comparison of the distribution of water types as calculated by the box model are in agreement with independent calculations from using fluorescence and salinity as tracers. Comparison of model-predicted and measured salinity distribution show reasonable agreement. Turn-over times, mean ages and residence times are calculated and it is shown that these time scales vary with fresh water discharge too. (Baker-IVI)
W85-01838

USE OF A MODEL TO ASSESS FACTORS AFFECTING THE OXYGEN BALANCE IN THE WATER OF THE DOLLARD,
Biologisch Centrum, Haren (Netherlands).
F. B. Van Es, and P. Ruardij.
Netherlands, Journal of Sea Research, Vol. 15, No. 3/4, p 313-330, December, 1982. 8 Fig, 1 Tab, 24 Ref.

Descriptors: *Estuaries, *Mixing, *Flushing, *Model studies, *Ems Estuary, *Dollard, Oxygen balance, Seasonal variation, Primary productivity, Reaeration.

A mathematical model was developed to calculate the contribution of several processes to the oxygen balance in the water of the Dollard, the inner part of the Ems Estuary. This model was based on a mixing and flushing model for the calculation of the dispersal of organic wastewater discharged to the Dollard. Measured data were available of background and total oxygen consumption and primary production in the water, sediment respiration and decomposition rates of the organic waste. This enabled a mean reaeration coefficient to be estimated. The model satisfactorily described the distribution of oxygen concentrations in the Dollard, both in time and space. In summer, the oxygen balance was determined to be the same amount by sediment respiration and oxygen consumption in the water, and in autumn largely by the waste discharges. The physical process of reaeration was the predominant oxygen providing process, though in summer primary production was important. The input of oxygen-rich water from the middle part of the estuary was of minor importance. During the highest waste water discharges the oxygen consumption in the mouth of the Dollard was 4 times the background level. Beyond that area the increase was negligible. (Baker-IVI)
W85-01839

PHOSPHORUS DISTRIBUTION IN SEDIMENTS OF THE DELAWARE RIVER ESTUARY,
Delaware Univ., Newark. Dept. of Geology.
R. N. Strom, and R. B. Biggs.
Estuaries, Vol. 5, No. 2, p 95-101, June, 1982. 4 Fig, 2 Tab, 34 Ref.

Descriptors: *Phosphorus, *Sediments, *Delaware River Estuary, Estuarine environment, Salinity, Iron oxyhydroxide, Clay, Calcium carbonate.

In order to determine the primary factors related to the accumulation of phosphorus in estuarine sediments, a study of phosphorus fractions in sediments of the Delaware River Estuary was undertaken. A correlation matrix between the phosphorus fractions, determined by serial extraction, and 14 sediment variables was computed. Total phosphorus and total inorganic phosphorus in the sediment-phosphorus reservoir decreases with increasing salinity. This variation is correlated with decreasing iron oxyhydroxide content in the sediment. Neither clay content nor calcium carbonate content appear to be significantly correlated with variation in total inorganic phosphorus content in the fine-grained sediments of this estuary. Although calcium phosphate is concluded to be a major constituent of the sediment-phosphorus reservoir, there was no evidence found that it is authigenic in this environment. (Author's abstract)
W85-01843

TIDAL AND SEASONAL VARIATIONS OF SULFATE ION IN A NEW JERSEY MARSH SYSTEM,
Kean Coll. of New Jersey, Union. Dept. of Chemistry-Physics.
For primary bibliographic entry see Field 5B.
W85-01848

TROPHIC RESPONSE OF FISHES TO HABITAT VARIABILITY IN COASTAL SEAGRASS SYSTEMS,
Florida State Univ., Tallahassee. Dept. of Biological Science.
R. J. Livingston.
Ecology, Vol. 65, No. 4, p 1258-1275, August, 1984. 7 Fig, 5 Tab, 57 Ref, 2 Append. EPA grant R-805288010.

Descriptors: *Fish, *Estuarine environment, *Habitats, *Water pollution effects, Water temperature, Pulp wastes, Storm runoff, Fish food, Fish behavior, Seagrasses, Environmental effects, Water quality, Macrophytes, Phytoplankton.

Shallow coastal areas of the northeast Gulf of Mexico are physically unstable in terms of short-term, seasonal, and year-to-year changes in temperature, salinity, nutrient concentration, and other water quality features. A 9-yr comparison was made of two estuaries, one polluted and one in the natural state, to determine the response of fish assemblages to habitat alteration in space and time. During the study period, extreme natural habitat changes due to storm water runoff and low winter temperatures were superimposed over water quality changes (increased color, turbidity, nutrients; reduced dissolved oxygen) associated with release of pulp mill effluents. Various grassbed fishes followed regular seasonal, age-specific feeding patterns, which did not change substantially in terms of qualitative foods composition in the unpolluted estuary over a 7-yr period of observation. Such feeding behavior helped to explain temporally conservative cycles of relative abundance despite extreme (natural) habitat change. Anthropogenous habitat alterations, though seemingly slight, were associated with reductions in benthic macrophyte distribution, enhanced phytoplankton productivity, and changes in the relative dominance and numerical abundance of associated fish assemblages. Grassbed species were replaced by plankton-feeding fishes, and disruption of feeding habits of various species benthic food organisms altered their feeding habits during the years of pollution in the affected estuary. Subsequent water quality improvement over time was associated with shifts in the age-specific dietary patterns of various species toward those observed in the unaffected estuary, although such recovery varied from species to species according to habitat utilization and trophic needs. From these results, it is clear that a relatively complex coastal seagrass system exposed to periodic, extreme natural disturbance is relatively resilient to such changes in terms of relative dominance and food web structure. However, apparently slight water quality changes due to pollution, which are outside the evolutionary experience of the biotic components, can cause serious disruptions of the basic habitat structure, energy flow, and community composition of the grassbed assemblages at various levels of biological organization. (Author's abstract)
W85-01890

226RA AND 228RA IN THE MIXING ZONES OF THE PEE DEE RIVER-WINYAH BAY, YANGTZE RIVER AND DELAWARE BAY ESTUARIES,
South Carolina Univ., Columbia. Dept. of Geology.
R. J. Elsinger, and W. S. Moore.
Estuarine, Coastal and Shelf Science, Vol. 18, No. 6, p 601-613, June, 1984. 5 Fig, 1 Tab, 22 Ref. NSF grants OCE-81-10405 and OCE-82-44535.

Descriptors: *Radium radioisotopes, *Estuarine environment, *Yangtze River, *China, *Pee Dee River, *Winyah Bay, *Delaware Bay, Desorption, Salinity, Sediments, Dilution, Diffusion, Mixing zone.

Ra-226 and Ra-228 have non-conservative excess concentrations in the mixing zones of the Pee Dee River-Winyah Bay estuary, the Yangtze River estuary, and the Delaware Bay estuary. Laboratory experiments, using Pee Dee River sediment, indicate desorption of Ra-226 to increase with increasing salinities up to 20%. In Winyah Bay desorption from river-borne sediments could contribute almost all of the increases for both isotopes. Desorption adds only a portion of the excess Ra-228 measured in the Yangtse River and adjacent Shelf waters and Delaware Bay. In the Yangtze River the mixing zone extends over a considerable portion of the Continental Shelf where Ra-228 is added to the water column by diffusion from bottom sediments, while Ra-226 concentrations decrease from dilution. Diffusion of Ra-228 from bottom sediments in Delaware Bay primarily occurs in the upper part of the bay (< 22% water) where fine grained sediments predominate. A diffusive flux for Ra-228 of 0.33 dpm/sq cm year was determined for Delaware Bay. (Author's abstract)
W85-01912

BEHAVIOR OF ORGANICALLY-BOUND IRON IN SEAWATER OF ESTUARIES,
Hokkaido Univ., Hakodate (Japan). Faculty of Fisheries.
K. Matsunaga, K. Igarashi, S. Fukase, and H. Tsubota.
Estuarine, Coastal and Shelf Science, Vol. 18, No. 6, p 615-622, June, 1984. 8 Fig, 19 Ref.

Descriptors: *Red tide, *Iron, *Estuarine environment, *Salinity, *Hakodate Bay, *Osaka Bay, *Japan, Eutrophication, Primary productivity, Flocculation, Phytoplankton, Heavy metals.

Two rivers and estuaries were selected for experiments on organically bound iron. The Kunebetsu River has its origin in Lake Ohnuma, and the river flows into Hakodate Bay. The estuary has normal primary production and no pollution. The other river is the Yodo River, which flows into Osaka Bay. The bay is contaminated with heavy metals and nutrients, and the estuary has red tide outbreaks during the summer. In Hakodate Bay, the iron complex decreases with increasing salinity because of its flocculation. In Osaka Bay, the iron complex as well as nutrients except silicate are completely assimilated by phytoplankton. Among nutrients, silicate diffuses only by water mixing because the main species of phytoplankton were green colored algae at the river mouth. High nitrite concentration was found at about 15% salinity. This means that both phytoplankton decomposition and photosynthesis occur. The iron complex assimilated would be released to seawater with the decomposition of phytoplankton and then red tide outbreaks at the estuary would continue for a long period. (Moore-IVI)
W85-01913

STATISTICAL ANALYSIS OF ESTUARINE PROFILES: II APPLICATION TO ARSENIC IN THE TAMAR ESTUARY (S.W. ENGLAND),
Marine Biological Association of the United Kingdom, Plymouth (England).
For primary bibliographic entry see Field 5B.
W85-01914

HYDROCARBONS IN WASHINGTON COASTAL SEDIMENTS,
Washington Univ., Seattle. School of Oceanography.
For primary bibliographic entry see Field 5B.
W85-01915

BENTHIC PHOSPHORUS REGENERATION IN THE POTOMAC RIVER ESTUARY,
Geological Survey, Reston, VA.
E. Callender.
Hydrobiologia, Vol. 92, p 431-446, July, 1982. 6 Fig, 47 Ref.

Descriptors: *Potomac River, *Estuaries, *Phosphorus, *Sediment-water interface, Phosphates, Sediments, Benthos, Estuarine environment, Primary production, Iron oxides, Interstital water, Cycling nutrients.

The flux of dissolved reactive phosphate from Potomac riverine and estuarine sediments is controlled by processes occurring at the water-sediment interface and within surficial sediment. In situ benthic fluxes (0.1 to 2.0 mmoles/sq m/day) are generally five to ten times higher than calculated diffusive fluxes (0.020 to 0.30 mmoles/sq m/day). The discrepancy between the two flux estimates is greatest in the transition zone (river mile 50 to 70) and is attributed to macrofaunal irrigation. Both in situ and diffusive fluxes of dissolved reactive phosphate from Potomac tidal river sediments are low while those from anoxic lower estuarine sediments are high. The net accumulation rate of phosphorus in benthic sediment exhibits an inverse pattern. Thus a large fraction of phosphorus is retained by Potomac tidal river sediments, which contain a surficial oxidized layer and oligochaete worms tolerant of low oxygen conditions, and a large fraction of phosphorus is released from anoxic lower estuary sediments. Tidal river sediment pore waters are in equilibrium with amorphous Fe(OH)3 while lower estuary pore waters are significantly undersaturated with respect to this phase. Benthic regeneration of dissolved reactive phosphorus is sufficient to supply all the phosphorus requirements for net primary production in the lower tidal river and is sufficient to supply all the phosphorus requirements for net primary production in the lower tidal river and transition-zone waters of the Potomac River Estuary. Benthic regeneration supplies approximately 25% as much phosphorus as inputs from sewage treatment plants and 10% of all phosphorus inputs to the tidal Potomac River. When all available point source phosphorus data are put into a steady-state conservation of mass model and reasonable coefficients for uptake of dissolved phosphorus, remineralization of particulate phosphorus, and sedimentation of particulate phosphorus are used in the model, a reasonably accurate simulation of dissolved and particulate phosphorus in the water column is obtained for the summer of 1980. (Author's abstract)
W85-02088

METHANE PRODUCTION IN MINNESOTA PEATLANDS,
Minnesota Univ., Navarre. Gray Freshwater Biological Inst.
R. T. Williams, and R. L. Crawford.
Applied and Environmental Microbiology, Vol. 27, No. 6, p 1266-1271, June, 1984. 1 Fig, 6 Tab, 20 Ref.

Descriptors: *Peat, *Methane, *Methane, Methanogenesis, Temperature, Hydrogen ion concentration, Metabolism, Dissolved gases.

Rates of methane production in Minnesota peats were studied. Surface (10- to 25-cm) peats produced an average of 228 nmol of CH4 per g (dry weight) per h at 25 degrees C and ambient pH. Methanogenesis rates generally decreased with depth in ombrotrophic peats, but on occasion were

observed to rise within deeper layers of certain fen peats. Methane production was temperature dependent, increasing with increasing temperature (4 to 30 degrees C), except in peats from deep layers. Maximal methanogenesis from these deeper regions occurred at 12 degrees C. Methane production rates were also pH dependent. Two peats with pHs of 3.8 and 4.3 had an optimum rate of methane production at pH 6.0. The addition to peat of glucose and H2-CO2 stimulated methanogenesis, whereas the addition of acetate inhibited methanogenesis. Cysteine-sulfide, nitrogen-phosphorus-trace metals, and vitamins-yeast extract affected methane production very little. Various gases were found to be trapped or dissolved (or both) within peatland waters. Dissolved methane increased linearly to a depth of 210 cm. The accumulation of metabolic end products produced within peat bogs appears to be an important mechanism limiting carbon turnover in peatland environments. (Author's abstract)
W85-02135

RELATIVE CONTRIBUTIONS OF BACTERIA AND FUNGI TO RATES OF DEGRADATION OF LIGNOCELLULOSIC DETRITUS IN SALT-MARSH SEDIMENTS,
Georgia Univ., Athens. Dept. of Microbiology.
R. Benner, S. Y. Newell, A. E. Maccubbin, and R. E. Hodson.
Applied and Environmental Microbiology, Vol. 48, No. 1, p 36-40, July, 1984. 3 Fig, 2 Tab, 24 Ref. NSF grant OCE-8117834 and Dept. of Commerce grant NA 80AA-D-00091.

Descriptors: *Salt marshes, *Bacteria, *Fungi, *Decomposition, *Lignocellulose, Detritus, Microorganisms, Mineralization, Wetlands, Spartina.

Specifically radiolabeled (C-14 lignin)lignocellulose and (C-14 polysaccharide)lignocellulose from the salt-marsh cordgrass Spartina alterniflora were incubated with an intact salt-marsh sediment microbial assemblage, with a mixed (size-fractionated) bacterial assemblage, and with each of three marine fungi, Buergenerula spartinae, Phaeosphaeria typharum, and Leptosphaeria obiones, isolated from decaying S. alterniflora. The bacterial assemblage alone mineralized the lignin and polysaccharide components of S. alterniflora lignocellulose at approximately the same rate as did intact salt-marsh sediment inocula. The polysaccharide component was mineralized twice as fast as the lignin component; after 23 days of incubation, ca. 10% of the lignin component and 20% of the polysaccharide component of S. alterniflora lignocellulose were mineralized. Relative to the total sediment and bacterial inocula, the three species of fungi mediated only very slow mineralization of the lignin and polysaccharide components of S. alterniflora lignocellulose. Experiments with uniformly C-14 labeled S. alterniflora material indicated that the three fungi and the bacterial assemblage were capable of degrading the non-lignocellulosic fraction of S. alterniflora material, but only the bacterial assemblage significantly degraded the lignocellulosic fraction. The results suggest that bacteria are the predominant degraders of lignocellulosic detritus in salt-marsh sediments. (Author's abstract)
W85-02138

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

EVALUTION OF HOLLOW FIBER ULTRAFILTRATION AS A PRETREATMENT FOR REVERSE OSMOSIS DESALINATION OF SEA-WATER,
Romicon, Inc., Woburn, MA.
B. R. Breslau, A. J. Testa, and B. M. Kilcullen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-212406, Price codes: A09 in paper copy, A01 in microfiche. Completion Report, (1984). 164 p, 106 Fig, 41 Tab. Project No. OWRT C-80309-S(8558)(1), Contract/Grant No. 14-34-0001-8558.

Descriptors: Membranes, *Ultrafiltration, *Pretreatment, Membrane processes, Reverse osmosis pretreatment, *Desalination.

An intensive study was conducted at the Wrightsville Beach Test Facility to evaluate the performance of hollow fiber ultrafiltration membranes as a pretreatment for seawater desalination via reverse osmosis. Several polymer types were evaluated to determine the best ultrafiltration membrane. In addition, two different fiber diameters (20 and 43 mil) were studied to investigate the effects of flow through the hollow fiber cartridge on flux, cleaning, and membrane life. The results from these tests show that the polysulfone PM-50 membrane (50,000 M.W. cutoff) which has a 43 mil internal diameter is well suited for seawater pretreatment. Various cleaning chemicals (sodium hydroxide, sodium hypochlorite, citric acid, surfactant types, etc.) were evaluated in several combinations of operating modes (reverse flow, backflush) to optimize the membrane performance. Economic analyses show that the three inch diameter, 26.5 square foot PM-50 hollow fiber cartridge can pretreat seawater at a cost of approximately one dollar per thousand gallons of seawater produced using a totally automated system.
W85-01830

3B. Water Yield Improvement

DEVELOPING THE RESOURCE POTENTIAL OF A SHALLOW WATER TABLE,
California Univ., Davis. Dept. of Land, Air and Water Resources.
D. W. Grimes, and D. W. Henderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-207315, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center Completion Report, April, 1984. 63 p, 14 Fig, 15 Tab, 36 Ref, 1 Append. Project No. OWRT B-216-CAL(1), Contract/Grant No. 14-34-0001-1210.

Descriptors: *Shallow water, *Evapotranspiration, *Water budget, *Irrigation scheduling, *Soil salinity, *Water salinity, *Plant water status, Perched water, Irrigation management, California, San Joaquin Valley.

Observations and estimates indicate that shallow water table encroachment affects increasingly large areas of agriculturally productive land in the central and western San Joaquin Valley. With current management techniques, the present drain and disposal facilities are inadequate to effectively handle the water volume that moves through soils and becomes a part of the shallow water system. In the presence of active plant roots, soil water is depleted in upper profile zones with the establishment of a potential gradient sufficient to effect upward capillary water movement in the presence of a shallow water table. A three-year study was done to evaluate the resource potential of shallow-perched water tables as a resource to meet crop evapotranspiration (ET) requirements. Using water-budget and chlorine-tracer techniques independently to measure shallow water table contributions to crop ET revealed that as much as 50 to 60 percent of crop ET could be met by the shallow water table. The amount of water contributed by the shallow water table was strongly conditioned by water table salinity and depth to the shallow water. Study results show the need for a total management system approach for effective utilization of the resource potential of shallow water tables in contrast to specific entities considered in isolation. (Snyder-California)
W85-01832

APPROPRIATE WATER SUPPLY TECHNOLOGY FOR DEVELOPING COUNTRIES,
For primary bibliographic entry see Field 5F.
W85-01981

DRINKING WATER IN DEVELOPING COUNTRIES - THE MINIMUM TREATMENT PHILOSOPHY. A CASE STUDY,
Norconsult A/S, Sandvika (Norway).
J. A. Myhrstad, and O. Haldorsen.
Aqua, No. 2, p 86-90, 1984. 2 Fig, 3 Tab, 7 Ref.

Descriptors: *Water quality control, *Developing countries, *Bacteria, *Water supply development, Drinking water, Water management, Water resources development, Sanitation.

A priority list is presented of items to be considered in selection of water sources. Selection of proper sources combined with proper intake arrangements and the introduction of sanitary zones requiring the simplest possible treatment methods should be an appropriate approach to a safe and sound water quality policy, referred to here as the minimum treatment philosophy. The study presented deals with specifics for water supply to the Kigoma Region in Tanzania. In this region it is bacteriological rather than chemical quality of the water which is a problem. Virtually all surface water sources (both existing and potential) are heavily polluted by bacteria regardless of the intake location. Consequently, all surface water sources should have their bacteriological quality improved prior to delivery to consumers. The source selection process in Tanzania should first consider use of waters not requiring disinfection: deep groundwater, properly protected shallow groundwater and properly protected springs; low-turbidity waters which can be directly disinfected including lakes and headwater reaches of streams; water requiring treatment prior to disinfection including streams and rivers and other sources that cannot be immediately disinfected or that require treatment for other reasons; and finally, water that cannot be treated by conventional means to comply with standards such as those containing high sulfates, nitrates, fluorides and other problems. (Baker-IVI)
W85-02018

WATER BALANCE AND CROPS IN KARNATAKA,
Andhra Univ., Waltair (India). Dept. of Meteorology and Oceanography.
For primary bibliographic entry see Field 2I.
W85-02127

3D. Conservation In Domestic and Municipal Use

RESTORATION OF FAILING ON-SITE WASTEWATER DISPOSAL SYSTEMS USING WATER CONSERVATION,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 5D.
W85-01656

STATE LAWS MANDATING WATER CONSERVATION,
Maryland Univ., College Park. Dept. of Geography.
For primary bibliographic entry see Field 6E.
W85-01806

RESULTS AND EXPERIENCE OF THE GREIZ WATER-SUPPLY DISTRICT IN THE FIELD OF RATIONAL WATER USE (ERGEBNISSE UND ERFAHRUNGEN DES VERSORGUNGS-BEREICHS GREIZ BEI DER RATIONELLEN WASSERVERWENDUNG),
U. Koschmieder, H. Tunger, and L. Hoffmann.
Wasserwirtschaft-Wassertechnik, Vol. 34, No. 2, p 37-39, February, 1984. 2 Fig.

Descriptors: *Water conservation, *Greiz, *East Germany, Water treatment, Wastewater treatment, Water management, Drinking water, Economic aspects, Water pollution control.

The Greiz water-supply district, German Democratic Republic, has chosen to implement rational

water use particularly by reducing water losses and by preventing water wastage. The basis for this plan was information exchange with other facilities, party policy on rational water use including the 1982 water law, and the Colbitz experience. Goals of the plan are a stable drinking-water supply, sewer system, and wastewater treatment; optimal use of available funds; savings in and return of investment; increasing worker productivity; reducing energy use and costs; instituting order and stability; and guaranteeing environmental protection while relieving the demands made on water as a natural resource. The main means of implementing the plan are to reduce water losses together with water demand within the district, to reduce the volume of drinking water used for industrial purposes, to decrease pollution by wastewater and recycle valuable chemicals, and to ensure adequate water quantity and quality. The means of achieving these ends include direction by the party organization within each facility, ideological and subject-specific instruction of workers and users; translation of results of technological and scientific studies into practice; participation of youth, innovators, and inventors; and close cooperation with water-management professionals in the district. (Gish-IVI)
W85-01880

STATUS OF RESEARCH AND DEVELOPMENT IN WATER SUPPLY SYSTEMS IN INDIA,
National Environmental Engineering Research Inst., Nagpur (India).
V. Raman, and B. B. Sundaresan.
Aqua, No. 1, p 19-22, 1983. 28 Ref.

Descriptors: *India, *Research priorities, *Water conveyance, *Operating policies, Administrative agencies, Water conservation, Metropolitan water management, Water management, Rural areas, Management planning, Leakage.

Until recently in India, it was not realized that research and development efforts in water supply systems should focus on conservation of water, energy and resources, simplicity of construction and maintenance, and operation without sacrificing water quality. Research and development has mostly concentrated on modifications to, development of, and innovations in the existing systems. Detailed field evaluation of selected rural water supply schemes are being carried out with the following objectives: to identify technological, organizational, adminstrative, financial, and sociocultural factors that have contributed to the success, or lack of success, of the schemes so as to provide proper feed-back for future planning, design, and implementation of rural water supply programs. A single agency is needed at state level with its functions decentralized at district level, to look after financial, administrative, and technical matters at state level and execution and maintenance at district level. Design criteria and specifications need to be revised to suit regional needs. In a survey of water distribution systems in cities and towns of India, it was determined that 20-35% of total flow in the systems is lost through leakage; the expenditure on a preventive maintenance program for the systems could be recovered in 12-18 months, based on the quantum of water saved. (Collier-IVI)
W85-01982

LEAKAGE CONTROL,
International Water Supply Association, London (England).
L. R. Bays.
Aqua, No. 1, p 51-55, 1984. 5 Ref.

Descriptors: *Leakage, *Water loss, *Water supply, Water conservation, Economic aspects, Costs, Resources development, Water resources development, Resources management.

Leakage or loss of water between source and consumer has been a cause for concern in many countries of the world for a long time. Water supplies all over the world are becoming increasingly aware of the need to make the fullest use of available water resources before investing money into further resources which may be of doubtful quality. International funding agencies require the reduction of high losses from systems before agreeing to financial help to develop new sources. The paper will attempt to outline the many aspects of leakage control with emphasis on an economical approach to the subject. The purpose of leakage control is to reduce consumption and the reduction of consumption also involves the reduction of 'waste' involving the education of consumers in their daily habits. It is therefore necessary to define the terms used in waste reduction quite carefully so that everyone has an understanding of what is meant and the paper will attempt to clarify terms used which are often misunderstood. The financial benefits of reducing consumption must be balanced against the cost of achieving such reductions. Water undertakings employing some techniques at present can often put their existing resources to more efficient use with resultant benefits. (Author's abstract)
W85-02016

3F. Conservation In Agriculture

WATER-USE PRODUCTION FUNCTIONS OF SELECTED AGRONOMIC CROPS IN NORTHWESTERN NEW MEXICO, PHASE II,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
C. E. Kallsen, E. J. Gregory, and T. W. Sammis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-195866, Price codes: A09 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute Technical Report No. 155, Las Cruces, October 1982. 180 p, 31 Fig, 61 Tab, 25 Ref, 6 Append. Project No. OWRT C-90229-G(9444)(2), Contract/Grant No. 14-34-0001-9444.

Descriptors: *Evaporation, *Transpiration, *Evapotranspiration, Water use efficiency, Evapotranspiration potential, Nitrogen, *New Mexico, Water requirements, Plant growth rates, Irrigation, Crop yield, Barley, Beans, Alfalfa.

The water requirement for growth of spring barley, pinto beans, and alfalfa was investigated in northwestern New Mexico. Results strongly suggest that the level of nitrogen fertility does not alter the water-use efficiency (WUE) of spring barley when WUE is expressed as a function of transpiraton. WUE may change, depending on irrigation scheduling, if WUE is expressed as a function of evapotranspiration. We attribute this difference to differential soil-water evaporation. Further evidence supports the hypothesis that a common function exists independent of season, with respect to a given crop, relating economic yield to transpiration. Crop coefficients based on various methods of calculating potential evapotranspiration were found to vary considerably, as much as 50 percent, between years due in part to the difference in the evaporation component of the measured evapotranspiration. Caution should be exercised in using crop coefficients to predict alfalfa, pinto beans and spring barley seasonal or intra-seasonal water requirements when the crops are grown under conditions requiring frequent light irrigation.
W85-01817

YIELD AND QUALITY OF COTTON GROWN WITH WASTEWATER,
Arizona Univ., Tucson. Dept. of Plant Sciences.
For primary bibliographic entry see Field 5D.
W85-01869

WATER CONSERVATION THROUGH LIMITED IRRIGATION OF CORN AND GRAIN SORGHUM IN THE GREAT PLAINS,
Nebraska Univ.-Lincoln. Dept. of Agricultural Engineering.
D. G. Watts, C. Y. Sullivan, W. F. Kroutil, and R. J. Supalla.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-207372. Price codes: A05 in paper copy, A01 in microfiche. Completion Report, (1984). 67 p, 43 Fig, 7 Tab. Project No. OWRT B-054-NEB(1), Contract/Grant No. 14-34-0001-0230.

Descriptors: *Water conservation, Water availability, *Evapotranspiration control, *Crop response, *Water yield improvement, Crop yield, Water stress, Farm management, *Irrigation efficiency, Great Plains, Corn, Grain sorghum.

The overall purpose was to conduct agronomic and economic evalution of the potential of limited irrigation of corn and grain sorghum for conserving and extending water supplies in the central Great Plains. A high linearity was found in the relationship between yield and evapotranspiration (ET) with both crops. The maximum yields in 1981 were obtained with less ET than in 1980, and the slope for yield reductions with decreased ET (limited irrigation) was greater in 1980 than in 1981. Higher mean relative humidity in 1981 may have contributed to this. When a factor was added to account for the effect of the relative humidity, the yield reductions became nearly constant. When ET-yield functions were normalized and expressed on a relative basis, the slopes for all varieties of a specific crop and at a particular location were very similar. In fact, the slopes for corn and sorghum were also similar for locations and years. However, on an actual yield-ET basis, differences in genotypes were apparent. Since project data shows the yield-ET regression is usually linear, a water supply which fails to meet the conditions for full ET demand would be expected to reduce yields. The rate reduction, or slope of the regression, may differ with environment, crop and variety. At higher ET values, corn equaled or exceeded sorghum yields.
W85-01952

IRRIGATED AGRICULTURAL EXPANSION PLANNING IN DEVELOPING COUNTRIES: INVESTMENT SCHEDULING INCORPORATING DRAINAGE WATER REUSE,
Cairo Univ., Giza (Egypt). Dept. of Irrigation and Hydraulics.
M. N. Allam, and D. H. Marks.
Water Resources Research, Vol. 20, No. 7, p 757-766, July, 1984. 3 Fig, 15 Tab, 33 Ref.

Descriptors: *Developing countries, *Irrigation, *Planning, *Water reuse, *Investment scheduling, Agricultural development, Optimization, Mathematical models, Drainage systems, Economies of scale, Irrigation water, Water quality.

Agricultural expansion planning in developing countries where there is extensive government involvement in the planning process can be defined in a two-level heirarchy. At the first level, the role of the agricultural expansion investment in achieving the strategic goals of the sector is to be determined. At the second level, analysis of the agricultural expansion is to be carried out in such a way that the strategic decisions from the first level can be implemented. The focus of this paper is on the analysis of investment scheduling, the major issue of the second level. A mathematical optimization model is built to aid in analyzing the scheduling problems of land development, crop selection, drainage water reuse, and capacity expansion of the irrigation and drainage networks. A minimum cost criterion is used, where costs of land development, farming, irrigation and drainage infrastructures, maintenance and operations, and pump stations are considered. The model has a nonlinear objective function to account for economies of scale and linear and nonlinear constraints. A fixed charge approximation is used for the nonconvex cost functions, and a mixed integer programming algorithm along with an enumeration procedure is used for solving the model. The solution procedure guarantees global optimality for the approximated problem. A hypothetical expansion of 70,000 acres (28,350 ha) based on data from the Nile Delta in Egypt is used as a case study to illustrate the procedure under different conditions of irrigation water quality. (Author's abstract)
W85-02142

IRRIGATED AGRICULTURAL EXPANSION PLANNING IN DEVELOPING COUNTRIES: INCOME REDISTRIBUTION OBJECTIVE,

Cairo Univ., Giza (Egypt). Dept. of Irrigation and Hydraulics.
M. N. Allam, and D. H. Marks.
Water Resources Research, Vol. 20, No. 7, p 767-774, July, 1984. 1 Fig, 13 Tab, 17 Ref.

Descriptors: *Developing countries, *Irrigation, *Planning, *Income redistribution, Agricultural development, Economic aspects, Optimization, Mathematical models.

The role of agricultural expansion investment in improving the income redistribution conditions in society has been of considerable concern to planners. In this paper an approach based on distributing the newly developed land to a poorer sector (landless farmers) in society to gain agricultural revenues and improve their income is investigated. A mathematical optimization model is built to determine the distribution of land and a pricing policy established for the new areas in such a way that (1) a specified (by the government) income increase to the farmers can be achieved, (2) a predetermined level of recovery of the expansion cost can be insured, (3) high agricultural efficiency in the new land can be maintained, and (4) redistribution benefits can be maximized. In a case study application of the model, no conflict is found between the economic efficiency and income redistribution critieria in agricultural expansion investment within the planning framework presented in the companion paper (Allam and Marks, this issue). For a specified cost recovery condition it is found that the least cost planning alternatives give the opportunity to the largest number of landless farmers to own the new land and receive a specified income increase from the agricultural revenues, but a conflict between government return from the investment and redistribution objectives is found. This conflict is addressed and the trade-off between the two objectives is illustrated. (Author's abstract)
W85-02143

REAL TIME IRRIGATION SCHEDULING VIA 'REACHING' DYNAMIC PROGRAMMING,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
S. Pleban, D. F. Heermann, J. W. Labadie, and H. R. Duke.
Water Resources Research, Vol. 20, No. 7, p 887-895, July, 1984. 6 Fig, 6 Tab, 8 Ref.

Descriptors: *Irrigation scheduling, *Computer models, *Real time, High Plains, Soil water, Costs, Dynamic programming, Optimization.

A large number of farm operations in the High Plains states have surface irrigation systems supplied by wells pumped at a fixed discharge rate. The scheduling of irrigations for such systems can be challenging if the farmer desires to avoid crop yield reduction due to insufficient soil moisture while minimizing irrigation costs. A dynamic programming model is formulated for determining surface irrigation schedules over the short term that minimize irrigation labor costs while meeting crop requirements under a limited water supply. The model is capable of solving high-dimensional problems by a 'reaching' forward algorithm that defines a surrogate state by using binary decision policies rather than by discretization of the actual state variables. Data from the Northern Colorado Research Demonstration Center were used for testing the viability of the algorithm and its practical usefulness for irrigators through simulated real time experiments. The model optimized the scheduling of nine field groups divided into a total of 24 fields. An 8% savings in irrigation costs resulted for two years, as compared with conventional scheduling, while maintaining acceptable soil moisture levels. Sizeable savings are potentially available through extension to large systems. (Moore-IVI)
W85-02155

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

FLOOD-PLAIN MANAGEMENT PROGRAM IN RAPID CITY, SOUTH DAKOTA,
South Dakota School of Mines and Technology, Rapid City. Dept. of Geology and Geological Engineering.
For primary bibliographic entry see Field 2E.
W85-01643

FLOOD ELEVATIONS FOR THE SOLEDUCK RIVER AT SOL DUC HOT SPRINGS, CLALLAM COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
L. M. Nelson.
Available from the OFSS, USGS, Box 25424, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4083, 1983. 17 p, 9 Fig, 1 Tab, 3 Ref.

Descriptors: Flood control, Maximum probable floods, *Flood peaks, Flood plain zoning, *Soleduck River, Clallam County, *Washington, 100-year floods.

Elevations and inundation areas of a 100-year flood of the Soleduck River, Washington, were determined by the U.S. Geological Survey for the area in the vicinity of the Sol Duc Hot Springs resort, a public facility in the Olympic National Park that under Federal law must be located beyond or protected from damage by a 100-year flood. Results show that most flooding could be eliminated by raising parts of an existing dike. In general, little flood damage is expected, except at the southern end of an undeveloped airstrip that could become inundated and hazardous due to flow from a tributary. The airstrip is above the 100-year flood of the Soleduck River.
W85-01773

STREAMFLOW CHARACTERISTICS OF THE YELLOWSTONE RIVER BASIN, MONTANA, THROUGH SEPTEMBER 1982,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01781

IMPROVEMENT OF FLOOD-FREQUENCY ESTIMATES FOR SELECTED SMALL WATERSHEDS IN EASTERN KANSAS USING A RAINFALL-RUNOFF MODEL,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2A.
W85-01786

PREDICTION OF PEAK FLOWS FOR CULVERT DESIGN ON SMALL WATERSHEDS IN OREGON,
Oregon State Univ., Corvallis. School of Forestry.
A. J. Campbell, R. C. Sidle, and H. A. Froehlich.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-212398, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Institute Publication WRRI-74, Oregon State Univ., Corvallis, January 1982. 96 p, 1 Fig, 5 Tab, 65 Ref, 4 Append. Project No. OWRT A-053-ORE(1), Contract/Grant No. 14-34-0001-1139.

Descriptors: *Flood frequencies, *Culverts, *Culvert design, *Flood peaks, *Peak flows, Watersheds, Forest engineering, Flood prediction, *Oregon, Forested watersheds, Small watersheds.

Forest engineers must estimate flood frequencies for very small watersheds when designing culvert installations. Empirical formulae and simplified rainfall runoff models require considerable judgement to give reasonable results. As an alternative, this study presents equations to predict peak flows on small watersheds in Oregon. Equations were developed from 80 watersheds ranging in size from 0.21 to 10.60 square miles. Six physiographic regions were used, based on previous flood frequency studies. In each region, annual peak flows from gaging stations with 20 or more years of record were analyzed using four flood frequency distributions (Gumbel, two-parameter log-normal, three-parameter log-normal, log Pearson type III). Log Pearson type III distribution was found suitable for all regions, based on the chi-square goodness of fit test. Floods with recurrence intervals of 10, 25, 50 and 100 years were related to physical and climatic indices of drainage basins by multiple regression analysis. Basin area was most important in explaining the variation of flood peaks in all regions. Mean basin elevation and mean annual precipitation were also significantly related to flood peaks in two regions in western Oregon. Equations to predict the 25-year flood were developed for each physiographic region. Average percent error for these regression equations ranged from 16.1 to 64.1 percent, the smaller errors being associated with the more humid regions. Confidence limits for the equations provide estimates of prediction uncertainties over the range of design flows. These equations provide a better basis for culvert design of small forested watersheds than rule of thumb or empirical methods.
W85-01820

REPORT ON HYDROELECTRIC POWER UTILIZATION AND RESERVED-WATER PROBLEMS (BERICHT UBER WASSERKRAFTUNTZUNG UND RESTWASSERPROBLEME).
Wasser, Energie, Luft, Vol. 75, No. 3, p 45-74, 1983. 13 Fig, 2 Tab, 14 Ref. (in German and French).

Descriptors: *Hydroelectric power, *Switzerland, *Reserved water, Hydroelectric plants, Construction, Costs, Electric power production, Water allocation, Economic aspects.

Switzerland is heavily dependent on other countries for its energy supply; in 1980, only one fifth of its energy was produced domestically, and of this, 90% was hydroelectric power (HEP). Expansion of HEP facilities can raise production somewhat, but will not cover the expected increase in electricity demand. Preparations before beginning construction of a medium-sized HEP plant take at least 6-8 yr, and construction requires a further 4-6 yr. An important criterion for assessing the suitability of a site is cost of production, though the necessity of covering demand is becoming increasingly important. In most cases, an HEP plant makes special use of public waters, for which the local authority must grant a concession in which all conditions are specified and which runs for 80 yr at most. The cost structure of an HEP facility is based on fixed costs; annual production costs have a minor influence on total annual cost. Electricity cost is only slightly dependent on market mechanisms. Utilization of HEP requires extensive construction and investments, which influence the economy, employment, water management, the environment, and the ecosystem. Any water diverted from the stream used by the HEP facility (reserved water) means a reduction in energy production and a rise in cost per kWH as well as the necessity for another compensating energy source. Conditions for utilization of reserved water should be specified in the water concession, and failure to comply should result in penalty. Other consequences of reserved water use are lower water taxes paid by the HEP plant to the authority, higher energy costs for the consumer, and inability to operate optimally for the HEP facility. In the long term, the ecological and land-use benefits derived from reserved-water use must be weighed against the environmental and economic disadvantages caused by the production of compensatory energy. (Gish-IVI)
W85-01855

TASKS OF THE DAM KEEPER (LES TACHES DU GARDIEN DE BARRAGE),
Bureau d'Ingenieurs-Conseils, Lausanne (Switzerland).
W. Indermaur.
Wasser, Energie, Luft, Vol. 76, No. 3/4, p 44-47, 1984. 2 Fig.

Descriptors: *Reservoir operation, *Dam keepers, *Legal aspects, Personnel, Maintenance.

The legal duties of the owner of a dam regarding control of its operation are reviewed, and the relations existing between all persons and organizations involved in supervision. The main duties of a dam keeper are: visual observation of the operation and the surroundings; execution of control measures; control and maintenance of the measurement installation and the control galleries. The qualities necessary in a dam keeper are: a sense of responsibility; initiative; ability to work independently; precision in work; and the ability to draft simple messages. (Moore-IVI)
W85-01859

RESULTS OF SURFACE-WATER, DYKE, AND COASTAL INSPECTION – WAYS TOWARD MORE EFFECTIVE INSPECTION FOR THE FUTURE,
E. Clausnitzer.
Wasserwirtschaft-Wassertechnik, Vol. 34, No. 1, p 2-3, January, 1984.

Descriptors: *Inspection, *Surface waters, *Dykes, *Coastal areas, *East Germany, Legal aspects, Monitoring, Water facilities, Water quality.

The German Democratic Republic Guideline for Capacity, Duties, Composition, and Method of Operation of the Inspection Commission came into effect as part of the 1982 Water Law and stresses the high level of responsibility of local councils for the monitoring of surface-water condition, use, and conservation and of the functional capacity of water facilities in their area. In fall 1982, 16,000 workers performed 4,100 water, dyke, and coastal inspections; over 20,000 workers from all sections of the population as well as representatives of government and social organizations carried out more than 5,800 inspections during both spring and fall 1983. In 1983, 77% of surface waters, 99% of dykes, and 90% of water facilities were inspected versus 70, 90, and 75%, respectively, in 1982. Functional capacity was satisfactory for 97.4% of surface waters, 99.6% of dykes, and 98.6% of water facilities in fall 1983, compared with 95.3, 98.7, and 95.9%, respectively, in spring 1983. In the first six months of 1983, the number of citations for unsatisfactory condition of water or facilities was 130, compared with 206 for the same period in 1982. Unsatisfactory conditions are rectified in order of importance using measures decided upon at the time of inspection. The participation of lay people in inspections has led to a greater sense of responsibility for water quality. The quality of inspection must be improved by participation of members of the forestry and agricultural communities, experienced citizens, and representatives of environmental organizations. (Gish-IVI)
W85-01874

SHALLOW GROUND-WATER FLOW AND DRAINAGE CHARACTERISTICS OF THE BROWN DITCH BASIN NEAR THE EAST UNIT, INDIANA DUNES NATIONAL LAKESHORE, INDIANA, 1982,
Geological Survey, Indianapolis, IN. Water Resources Div.
R. J. Shedlock, and W. E. Harkness.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4271, 1984. 37 p, 14 Fig, 8 Ref.

Descriptors: *Drainage ditches, *Groundwater, Hydrologic models, *Indiana, Lake Michigan, National Parks, Organic soils, *Sand aquifers, *Unconfined aquifers, Water table decline, Wetlands, Drainage-ditch maintenance, Porter County, *Streambed gradients, The Pines.

Brown ditch drains wetlands between three parallel ridges of sand dunes near the East Unit of Indiana Dunes National Lakeshore in Poter County, Indiana. Dune and lacustrine sands form a surficial aquifer that is the source of base flow to the ditch. Profiles established in July and August 1982 show that the average streambed slope of the ditch in the Lakeshore (0.19 percent) is six times that of the upstream east reach in the adjacent town, The Pines (0.03 percent). Although the ditch contains debris and vegetation, the reach in the Lakeshore seems to convey all the base flow it receives. In contrast, the upstream east arm contains several ponded sections where flow is sluggish. Digital model simulations show that dredging to form a uniformly graded streambed and eliminate ponding in the upstream east arm of the ditch south of The Pines could lower the water table 0.2 to 2.0 feet in The Pines. Lowering the ditch stage in the Lakeshore by 0.5 to 1.0 foot would cause additional water-table decline of less than 0.5 foot in The Pines. Lowering the ditch stage both in the Lakeshore and in The Pines could lower the water-table in the Lakeshore by nearly 1.0 foot. (USGS)
W85-01948

FLOOD POTENTIAL OF FORTYMILE WASH AND ITS PRINCIPAL SOUTHWESTERN TRIBUTARIES, NEVADA TEST SITE, SOUTHERN NEVADA,
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-02037

MAGNITUDE AND FREQUENCY OF FLOODS FROM URBAN STREAMS IN LEON COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. A. Franklin, and G. T. Losey.
Available from OFSS, USGS, Box, 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 84-4004, 1984. 37 p, 10 Fig, 8 Tab, 31 Ref.

Descriptors: *Flood frequency, *Rainfall-runoff, *Unit hydrograph, Data collections, *Florida, Leon County, Urban areas.

Techniques are provided for estimating flood magnitudes for urban-flow streams in Leon County, Florida, for recurrence intervals of 2, 5, 10, 25, 50, 100, and 500 years. Synthetic flood peaks were generated by using a calibrated lumped-parameter rainfall-runoff model, pan evaporation data from Milton, Florida, and long-term unit rainfall records from Thomasville-Collidge, Georgia, and Pensacola, Florida. The flood peaks were used in multiple linear regression analyses to derive regional equations relating flood magnitude to basin characteristics. Significant basin characteristics were drainage area and impervious area. The average standard error of prediction ranged from + or - 32 percent for the 5-year recurrence interval to + or - 47 percent for the 500-year recurrence interval flood. (USGS)
W85-02047

FLOODS OF AUGUST 7-8, 1979, IN CHAUTAUQUA COUNTY, NEW YORK, WITH HYDRAULIC ANALYSIS OF CANADAWAY CREEK IN THE VILLAGE OF FREDONIA,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-02051

EFFECTS OF SEDIMENTATION ON THE STORAGE CAPACITY OF THE HIGH ASWAN DAM RESERVOIR,
Ministry of Irrigation, Cairo (Egypt). Research Inst. of High Dam Side Effects.
S. Shalash.
Hydrobiologia, Vol. 92, p 623-639, July, 1982. 12 Fig, 14 Tab, 2 Ref.

Descriptors: *Nile River, *Egypt, *High Aswan Dam, Storage capacity, *Sedimentation, Dam effects, Suspended sediments, Flood discharge, Dead storage.

The River Nile receives most of its sediment load from the Atbara and Blue Nile rivers, which carry eroded sediments north from the Ethiopian mountains during the seasonal flood between August and October. Prior to the construction and operation of the High Aswan Dam, in 1964, 9-10 x 10 to the 6th metric tons of suspended sediment were deposited annually in the flood plain of the Nile, while about 93% of the total average annual suspended load of 124 x 10 to the 6th metric tons was carried out into the Mediterranean Sea. Since the full operation of the High Aswan Dam in 1968, the flood discharge of the Nile, below the dam, has been greatly modified and more than 98% of the total suspended load has been retained within the reservoir. Based on long-term records, estimated relationships between discharge and suspended load, and field measurements, the life span of the dead storage capacity has been estimated at a minimum of about 360 years. Although this preliminary calculation is less than the estimated design capacity of 450 years, it is expected that progressively more suspended solids will be released in the outflow of the reservoir and that together with the use of flood diversion schemes the High Aswan Dam is likely to approach its design life span. (Author's abstract)
W85-02101

INVESTIGATION OF TWO POSSIBLE MODES OF ACTION OF THE INERT DYE AQUASHADE ON HYDRILLA,
University of South Florida, Tampa. Chemical and Environmental Management Services Center.
D. C. Manker, and D. F. Martin.
Journal of Environmental Science and Health, Vol. A19, No. 6, p 725-733, 1984. 2 Fig, 1 Tab, 10 Ref.

Descriptors: *Hydrilla, *Aquatic weed control, *Aquashade, Submersed plants, Plant growth, Shading, Photodynamic action.

The response of the submersed plant Hydrilla verticillata (Royle) in well water solutions of the inert dye Aquashade was measured. Growth rate was measured as increase in wet weight following two weeks in a phytotron room at 125 micro E/sq m/sec. It was found that plants treated with 3 ppm Aquashade grew 30.8% +/- 9.9% compared to plants without Aquashade which grew 62.0% +/- 18%. The two mechanisms of action which were investigated were shading and photodynamic action. A plot of percent growth versus concentration of Aquashade showed exponential decrease owing to shading. Available data indicate that the effect of shading is the major, if not exclusive, mode of action affecting the growth of hydrilla. (Author's abstract)
W85-02122

WATER HYACINTH CANOPY AND PAN EVAPORATION,
Meteorological Office, Poona (India).
L. S. Rathore, S. J. Maske, and S. K. Shaha.
Mausam, Vol. 35, No. 1, p 81-86, 1984. 5 Fig, 4 Tab, 3 Ref.

Descriptors: *Pan evaporation, *Water hyacinth, *Water loss, *Aquatic weeds, *Evaporation, *Evapotranspiration, *Vaporization, India, Climatic data, Weather patterns, Canopy, Air temperature, Transpiration control.

Using an open pan evaporimeter covered with water hyacinth, water loss was compared to a pan evaporimeter not covered by this aquatic weed. Meteorological parameters such as wind speed, rainfall, air temperature, water, temperature and canopy temperature were taken into consideration. The influence of water hyacinth canopy on water losses from free water surfaces doubles the water losses due to the plants higher transpiration rate. The application of a water budget to the canopy area provides the quantity of water vaporized from it during a particular budget period. These values of water loss will be helpful in water management,

irrigation and other agricultural operations. (Wheatley-IVI)
W85-02128

CASE FOR AUTOMATED WATER MANAGEMENT,
For primary bibliographic entry see Field 6A.
W85-02130

USE OF MODELS FOR WATER RESOURCES MANAGEMENT, PLANNING, AND POLICY,
Office of Technology Assessment, Washington, DC.
For primary bibliographic entry see Field 6A.
W85-02146

DESCRIPTIVE DECISION PROCESS MODEL FOR HIERARCHICAL MANAGEMENT OF INTERCONNECTED RESERVOIR SYSTEMS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
R. I. Adiguzel, and O. Coskunoglu.
Water Resources Research, Vol. 20, No.7, p 803-811, July, 1984. 6 Fig, 3 Tab, 40 Ref, 1 Append.

Descriptors: *Model studies, *Multireservoir networks, *Reservoir operation, Optimization, Decision making, Planning, Multipurpose reservoirs.

A significant limitation of prescriptive optimization models is that their formulation is disassociated from the behavioral and organizational attributes of the problem addressed. In an attempt to alleviate this limitation a decision process model is formulated directly within a framework of decision agents involved in integrated long- and short-term planning and management of multipurpose and multireservoir system operations. The resulting model is hierarchical, multilevel, multilayer, and decentralized. As such it is descriptive of a reservoir system managed and operated by geographically separated multiple agents with different authorities and responsibilities. Robustness and performance of the model is investigated by using the Shasta-Trinity system of California as an example. Results are encouraging for the descriptive as well as prescriptive relevance of the model. (Author's abstract)
W85-02147

4B. Groundwater Management

WATER-LEVEL CHANGES IN THE HIGH PLAINS REGIONAL AQUIFER, NORTHWESTERN OKLAHOMA, PREDEVELOPMENT TO 1980,
Geological Survey, Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01771

WATER RESOURCES OF THE FORT UNION COAL REGION, EAST-CENTRAL MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01772

LP EMBEDDED SIMULATION MODEL FOR CONJUNCTIVE USE MANAGEMENT OPTIMIZATION,
Nevada Univ. System, Reno. Water Resources Center.
C. R. Koltermann.
Available from the National Technical Information Services, Springfield, VA 22161 as PB84-202522, Price codes: A07 in paper copy, A01 in microfiche. Publication 41091, November 1983. 134 p, 31 Fig, 11 Tab, 50 Ref, 3 Append. Project No. OWRT A-103-NEV(1), Contract/Grant No. 14-34-0001-2130.

Descriptors: *Conjunctive use, *Linear programming, *Simulation analysis, Management planning, *Optimization, Groundwater management, Numerical analysis, *Model studies.

Equations for groundwater flow and surface water continuity are embedded in a linear programming hydraulic management model for the optimal conjunctive use of a groundwater and surface water system. This management model uses groundwater and surface water variables directly as decision variables. Problem reduction methods by reduction of decision variables and reduction of constraints, is of little utility. Time was incorporated in a lumped transient formulation in which all time periods are executed at once and in a step-wise procedure in which final heads from current time step are used as initial heads in the next time step. The hydraulic management approach is valid for the groundwater model, but appears too simplistic for the conjunctive use model. The embedding method is useful for small problems over a limited number of time steps, but encountered numerical difficulties when applied to a large real-world problem.
W85-01801

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN CHAMBERS, LIBERTY, AND MONTGOMERY COUNTIES, TEXAS, 1975-79,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01818

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN BRAZORIA, FORT BEND, AND WALLER COUNTIES, TEXAS, 1975-79,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01819

GROUND WATER IN THE REDDING BASIN, SHASTA AND TEHAMA COUNTIES, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
M. J. Pierce.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4052, 1983. 37 p, 7 Fig, 8 Tab, 23 Ref.

Descriptors: *Geohydrology, *Groundwater basins, *Groundwater level, Groundwater movement, Groundwater recharge, Groundwater storage, Water quality, *California, Redding Basin, Central Valley.

An appraisal of ground-water conditions in the Redding Basin was made by the U.S. Geological Survey and the California Department of Water Resources during 1979 and 1980. The basin covers about 510 square miles in the northern part of the Central Valley of California. Ground water in the basin is obtained principally from wells tapping continental deposits of Tertiary and/or Quaternary age. These deposits are arranged in a synclinal structure that trends and plunges southward. Recharge to the basin is from subsurface inflow; infiltration of precipitation and excess irrigation water; and percolation of certain reaches of streams and creeks. Ground-water movement is generally from the periphery of the basin towards the Sacramento River. Hydrographs for the period 1956 to 1970 show only a slight water-level decline and virtually no change between 1970 and 1979. The total estimated pumpage for 1976 was 82,000 acre-feet. Estimated usable storage capacity for the basin is about 5.5 million acre-feet. Chemical quality of ground water is rated good to excellent. Water type is a magnesium-calcium bicarbonate in character. The underlying Chico Formation contains saline marine water which is of poor quality. (USGS)
W85-01945

APPRAISAL OF WATER FROM SURFICIAL-OUTWASH AQUIFERS IN TODD COUNTY AND PARTS OF CASS AND MORRISON COUNTIES, CENTRAL MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
C. F. Myette.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report, 1984. 43 p, 21 Fig, 8 Tab, 31 Ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, Water quality, Hydrologic models, Todd County, Morrison County, Cass County, *Minnesota.

Outwash deposits consisting of medium to very coarse sand are an important aquifer in Todd County and in parts of Cass and Morrison Counties, Minnesota. The outwash ranges in thickness from 0 to 150 feet. Depth to water is generally less than 15 feet and annual water-level fluctuations are less than 5 feet. Aquifer-test results indicate that transmissivities range from 4,600 to 18,500 feet squared per day and storage coefficients range from 0.10 to 0.25. Well yields of more than 2,000 gallons per minute can be obtained locally in properly constructed wells. The water is a calcium bicarbonate type and is generally suitable for most uses. The water is hard to very hard with dissolved-solids concentrations ranging from about 200 to 400 milligrams per liter. Locally, nitrates are as much as 6.4 milligrams per liter. Pesticides are present in elevated concentrations but do not exceed U.S. Environmental Protection Agency recommended limits for domestic consumption. Results from numerical modeling experiments indicate that, with proper development, the groundwater system is capable of accommodating additional withdrawals. (USGS)
W85-02038

AQUIFER TESTS IN THE STRATIFIED DRIFT, CHIPUXET RIVER BASIN, RHODE ISLAND,
Geological Survey, Providence, RI.
For primary bibliographic entry see Field 2F.
W85-02039

HYDROGEOLOGY OF WELL-FIELD AREAS NEAR TAMPA, FLORIDA, PHASE 2--DEVELOPMENT AND DOCUMENTATION OF A QUASI-THREE-DIMENSIONAL FINITE-DIFFERENCE MODEL FOR SIMULATION OF STEADY-STATE GROUND-WATER FLOW,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-02052

COMPETITION VERSUS OPTIMAL CONTROL IN GROUNDWATER PUMPING WHEN DEMAND IS NONLINEAR,
New Mexico Univ., Albuquerque. Dept. of Mathematics and Statistics.
R. C. Allen, and M. Gisser.
Water Resources Research, Vol. 20, No. 7, p 752-756, July, 1984. 2 Fig, 3 Tab, 12 Ref.

Descriptors: *Water demand, *Groundwater management, *Water use, *Competition, *Optimal control, Pumping, Agriculture, Water rights.

Optimal control versus no control in groundwater pumping is considered under the assumption of a nonlinear demand function for water use. This study considers the case where many farmers and other users pump water from a common aquifer. Exclusiveness is present in the aquifer, since only farmers who own land overlying the aquifer can pump water, and other farmers are excluded from the resource. Cities and nonfarm producers own limited water rights, and can increase their water use only by purchasing water rights from other users. For the case of the nonlinear demand function, if water rights are properly defined and if the storage capacity of the aquifer is relatively large, the difference between a strategy of no control and a strategy of optimal control is small and thus can be ignored for practical policy considerations. Even if simulated optimal control yields slightly

better results than no control, a strategy of no control is likely to yield better results than optimal control, unless one is sure that the estimated demand for groundwater is very close to the true demand. (Moore-IVI)
W85-02141

4C. Effects On Water Of Man's Non-Water Activities

LAND USE, RUNOFF AND RECHARGE ON SELECTED WATERSHEDS IN THE U.S. VIRGIN ISLANDS,
Caribbean Research Inst., St. Thomas, VI.
H. Smith, and O. Ajayi.
Technical Report No. 13, September 1983. 57 p, 10 Fig, 11 Tab, 33 Ref. Project No. OWRT A-012-VI(1), Contract/Grant No. 14-34-0001-2150.

Descriptors: *Land use, *Surface runoff, *Rainfall-runoff relationships, Groundwater recharge, *Natural recharge, Land management, Land development, Surface-groundwater relationships, *Watersheds, *Virgin Islands, *St Thomas, West Indies.

Three watersheds with different land use characteristics on St. Thomas, Virgin Islands were instrumented and monitored to study the effects of various land use patterns on runoff and groundwater recharge. The water crop (combined runoff and groundwater recharge) for each watershed was calculated using two different methods, and the runoff determined independently using a Soil Conservation Service method. While results illustrated the effect of different land uses on recharge, the wide discrepancies in results according to the method applied highlighted the need for extensive data collection for such a study to be conclusive.
W85-01799

GROUND-WATER HYDROLOGY AND QUALITY BEFORE AND AFTER STRIP MINING OF A SMALL WATERSHED IN JEFFERSON COUNTY, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
A. C. Razem.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4215, 1984. 39 p, 18 Fig, 5 Tab, 12 Ref.

Descriptors: Coal, *Groundwater, *Strip mines, Sedimentary rocks, Perched water, Observation wells, Spoil banks, *Base flow, *Ohio, Jefferson County.

Ground-water conditions before and after surface mining of a small watershed are described as part of a study to determine the effects of mining on hydrologic systems. The watershed was underlain by stratified sedimentary rocks containing local aquifers above shaley clay beds associated with the major coal seams. Mining involved removing the overburden rocks, including most of the top aquifer, stripping the coal, and recontouring the overburden spoils to the approximate premining shape of the watershed. Replacement of the top aquifer by spoils during regrading has caused many changes in recharge and discharge rates, saturated thickness, aquifer characteristics, and water quality. In the middle aquifer there were changes in saturated thickness and water quality. Resaturation of the top-aquifer spoils during and after reclamation has been slow. Saturated thicknesses have ranged from zero initially after mining to 4 feet after 1 1/2 years. Water levels in the middle aquifer have risen from a few feet to 40 feet. Water quality generally has been degraded: concentrations of bicarbonate, calcium, magnesium, chloride, iron, manganese, sulfate, and dissolved solids have increased. Premining water types remained about the same after mining, except for some changes from bicarbonate type to sulfate type. (USGS)
W85-01943

FLOOD-FREQUENCY ESTIMATES FOR FIVE GAGED BASINS IN WICHITA, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2A.
W85-01949

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE CORRAL CREEK AREA, HANGING WOMAN CREEK COAL FIELD, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 5B.
W85-02040

HYDROLOGY OF AN ABANDONED COAL-MINING AREA NEAR MCCURTAIN, HASKELL COUNTY, OKLAHOMA,
Geological Survey, Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 5B.
W85-02041

MAGNITUDE AND FREQUENCY OF FLOODS FROM URBAN STREAMS IN LEON COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4A.
W85-02047

SEDIMENT CONCENTRATIONS FROM INTENSIVELY PREPARED WETLAND SITES,
Clemson Univ., SC. Belle W. Baruch Forest Science Inst.
G. R. Askew, and T. M. Williams.
Southern Journal of Applied Forestry, Vol. 8, No. 3, p 152-157, August, 1984. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Sedimentation, *Logging, *Drainage systems, *Bay lands, *South Carolina, *Suspended sediments, Erosion, Roads, Drainage ditches, Construction Wetlands, Water pollution sources, Water pollution control.

Conversion of pocosin and bay lands in the southeastern US from natural hardwood stands to loblolly pine plantations usually involves the installation of some form of drainage system followed by logging, site preparation, and planting. The drainage system may provide a pathway for sediment produced by these activities to reach natural streams. Suspended sediment concentrations were measured in water draining from a 5,900-acre Carolina bay located in southeastern Georgetown County, South Carolina, which is undergoing conversion to loblolly pine plantations. Samples were collected during the first storm-flow event of each month between January 1981 and December 1982 from subwatersheds involved in some of several phases of conversion. Suspended sediment concentrations in water draining from the bay averaged 16 mg/l despite logging, site preparation road maintenance and use, and installation of drainage ditches. Road erosion and ditch installation produced the highest suspended sediment concentrations. Suspended sediment concentrations decreased substantially with increasing distance from the sediment source. Logging and site preparation did not lead to increased sedimentation as long as heavy equipment was not allowed to operate in the ditches. Apparently on the flat coastal soils overload flow normally transports sediment only from roads or from disturbed sites immediately adjacent to drainage ditches. One way to minimize the impact of roads and new drainage ditches is to use a drainage system that contains a length of main channel between sediment sources and sensitive areas. (Moore-IVI)
W85-02112

EFFECT OF CLEAR-CUT SILVICULTURE ON DISSOLVED ION EXPORT AND WATER YIELD IN THE PIEDMONT,
Georgia Univ., Athens. School of Forest Resources.
For primary bibliographic entry see Field 5B.
W85-02171

4D. Watershed Protection

SEDIMENT TRANSPORT IN THE TANANA RIVER NEAR FAIRBANKS, ALASKA, 1980-81,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 2J.
W85-01788

EROSION CONTROL AT HIGH ALTITUDES (EROSIONSBEKAMPFUNG IM HOCHGEBIRGE),
Buero fuer Landschaftsplanung, Uster (Switzerland).
T. Weibel.
Wasser, Energie, Luft, Vol. 76, No. 3/4, p 62-63, 1984. 3 Fig.

Descriptors: *Erosion control, *High altitude, *Vegetation, *Austria, Trees, Forests, Stream erosion, Stream banks, Bank stabilization, Floods.

Biological means of erosion control in the Austrian high Alps were the subject of the Biological Engineering Association's fourth annual conference, held in Brixen, Austria. Emphasis was placed on steep slopes and on running water. In the South Tyrol, spruce, larch, and Scotch fir offer maximum erosion protection. The difficulty of finding suitable species and the seeds thereof for planting in eroded areas (in order to stabilize them) at the edge of forests at altitudes of 2,500 m produced less than satisfactory results. Zanggenbach is a stream whose bed was anchored with barriers 10 yr ago. Lack of bank reinforcement has resulted in the stream scouring into its banks between the barriers. Since 1980, its flow profile has been undergoing restoration and is being secured by plantings on the banks; stone blocks at the foot of the planting sites prevent the stream from undermining them. There is a head of 3 m between stream barriers, which is the maximum for biological bank stabilization. Proof of success of the plantings was seen when they withstood tractive stresses of 12 and 22 kg/sq m 6 and 15 mo after planting during the floods of October 1980 and July 1981. The limited success of measures at Piz Culac, 1,900-1,100 m above sea level where forests were planted to secure eroded areas was attributed to the use of unsuitable species. (Gish-IVI)
W85-01863

ENSURING A HIGH LEVEL OF EFFECTIVENESS AND INTENSITY OF AGRICULTURAL AND WATER-MANAGEMENT PRODUCTION IN DRINKING-WATER CATCHMENT AREAS (SICHERUNG HOHER EFFEKTIVITAT UND INTENSITAT DER LANDWIRTSCHAFTLICHEN UND WASSERWIRTSCHAFTLICHEN PRODUKTION IN TRINKWASSER-EINZUGSGEBIETEN),
Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie.
S. Dyck, U. Grunewald, and D. Uhlmann.
Wasserwirtschaft-Wassertechnik, Vol. 34, No. 3, p 56-58, April, 1984. 2 Fig, 14 Ref.

Descriptors: *Watershed protection, *Agriculture, *East Germany, Catchment areas, Drinking water, Water management, Land use, Cycling nutrients, Hydrologic models.

Rational use and effective protection of natural resources are vital components of the German Democratic Republic's economic strategy for the 1980s. Since the ground acts as a reservoir for nutrients and water, the implementation of these goals with regard to drinking water is largely dependent on integrating the interests of intense agricultural production and those of water management in drinking-water catchment areas (comprising about 14% of the country's agricultural land). Interdisciplinary research is being conducted in drinking-water reservoir catchment areas in the Erz mountains with the aim of developing general principles for planned, scientifically-based multiple land use in all catchment areas in the hard-rock region. The studies will also objectify and revise existing restrictions on agricultural land use, cattle

farming, and communal land use. Especially significant is the development of methods of analyzing interrelationships between land, plants, and animals determined by natural cycles (e.g., nitrogen, phosphorus, agricultural, or water cycles) and their effect on water resources. Such complex analysis also places new demands on intradisciplinary research: e.g., the old block model of hydrological processes is no longer adequate and is replaced by continuous process analysis of separate flow components. (Gish-IVI)
W85-01883

SEDIMENT TRANSPORT IN THE LOWER YAMPA RIVER, NORTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2J.
W85-02045

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

PRELIMINARY FINDINGS OF THE PRIORITY POLLUTANT MONITORING PROJECT OF THE NATIONWIDE URBAN RUNOFF PROGRAM,
Dalton-Dalton-Newport, Inc., Cleveland, OH.
R. H. Cole, R. E. Frederick, R. P. Healy, and R. G. Rolan.
Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 898-908, July 1984. 1 Fig, 7 Tab, 10 Ref.

Descriptors: *Monitoring, *Pollutant identification, *Organic compounds, *Urban runoff, *Metals, Pentachlorophenol, Copper, Lead, Zinc, Cadmium, Path of pollutants.

Twenty-four pollutants were detected in at least 10% of the urban runoff samples. These were selected for further evaluation and consideration of their implications in water quality protection and maintenance. The organic priority pollutants found most frequently in the predominantly residential and commercial area samples pose little risk to humans at detected levels. The predominant pathway for human exposure to the organics associated with gasoline is through ingested food and inhalation, so that contaminated surace water should pose little risk at the levels measured in Nationwide Urban Runoff Program (NURP) samples. Some of the priority pollutant metals in urban runoff could represent a potential risk to human health. The noncarcinogenic human health criteria, drinking water standards, and human carcinogenic criteria were exceeded. Nickel concentrations in undiluted runoff exceeded the human health criterion of 13.4 micro g/liter in 30% of the samples. Arsenic concentrations in undiluted runoff frequently exceeded the EPA human carcinogenic criterion. Because most storms last between 2 and 16 hours, the most meaningful measure of potential aquatic life effects is a comparison of pollutant concentrations with acute water quality criteria and toxicity values. If pollutant levels exceed these values before dilution, then aquatic species are likely to be impacted in the mixing zone. Pentachlorophenol was the only organic priority pollutant to exceed freshwater acute aquatic life criteria. Four priority pollutant metals, Cd, Cu, Pb, and Zn, exceeded freshwater acute aquatic life criteria in 9 to 50% of the samples. (Baker-IVI)
W85-01661

DETERMINATION OF ORGANOHALOGENIC ACIDS IN WATER SAMPLES (BESTIMMUNG HALOGENORGANISCHER SAUREN IN WASSERPROBEN),
Bremen Univ. (Germany, F.R.). Fachbereich Chemie/Biologie.
U. Lahl, B. Stachel, W. Schroer, and B. Zeschmar.
Zeitschrift fur Wasser und Abwasser Forschung, Vol. 17, No. 2, p 45-49, 1984. 7 Fig, 5 Tabs, 5 Ref.

Descriptors: *Halogenated hydrocarbons, *Trichloroacetic acid, *Chlorination, Chemical analysis, Hypochlorite, Humic acids, Lignin sulfonic acids, Bromine, Drinking water, Swimming pools, Tribromacetic acid, Surface water.

A method for the determination of halogenorganic acids in water samples is presented. As the results of the analyses show, trichloroacetic acid (TCA) seems to be a by-product of drinking water chlorination. Laboratory experiments show, that TCA is generated by reaction of hypochlorite with humic and ligninsulfonic acids. Furthermore in the presence of comparatively high bromide concentrations the generation of tribromoacetic acid (TBrA) could be seen. Analytical results of different drinking, surface and swimming pool water samples are presented. Mean concentrations of 36 micro g/l TCA were found in the water of several public swimming pools. (Author's abstract)
W85-01663

DETERMINATION OF CHLORINE DIOXIDE AND CHLORITE IN DRINKING-WATER (BESTIMMUNG VON CHLORDIOXID UND CHLORIT IM TRINKWASSER),
Technische Univ., Munich (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie.
For primary bibliographic entry see Field 5F.
W85-01664

DETERMINATION OF 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN IN TREATED WASTEWATER,
Dow Chemical Co., Midland, MI. Analytical Labs.
T. L. Peters, T. J. Nestrick, and L. I. Lamparski.
Water Research, Vol. 18, No. 8, p 1021-1024, 1984. 2 Fig, 1 Tab, 4 Ref.

Descriptors: *TCDD, *Wastewater analysis, Dioxins, Gas chromatography, Mass spectrometry.

The EPA recently proposed a procedure designated as Method 613 for the determination of parts-per-trillion concentrations of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in wastewater effluents. Interference problems encountered while attempting to utilize this procedure led to modifications which shorten the analysis time, simplify the procedure and improve the recoveries. A combination of cleanup steps on silica, alumina, and reactant modified adsorbents yields a relatively interference-free residue when examined by gas chromatography/mass spectrometry in the selected ion monitor (SIM) mode of operation. (Moore-IVI)
W85-01729

DETERMINATION OF OXIDANTS FORMED UPON THE DISINFECTION OF DRINKING WATER WITH CHLORINE DIOXIDE,
Louisiana State Univ., Baton Rouge. Inst. for Environmental Studies.
B. Limoni, E. Choshen, and Ch. Rav-Acha.
Journal of Environmental Science and Health, Vol. A19, No. 8, p 943-957, December, 1984. 3 Fig, 3 Tab, 17 Ref.

Descriptors: *Disinfection, *Drinking water, *Oxidants, *Chlorine dioxide, *Israel, Chlorine, Chlorate, Chlorite, Water treatment, Halogenated hydrocarbons.

The disinfection policy of the National Water Carrier of Israel has recently been changed from chlorine to chlorine dioxide. The need for a precise determination of ClO2 and all its inorganic by-products has been recognized. A careful study of the analytical methods needed for such precise determinations leads to the conclusion that combined methods should be applied simultaneously. While the specific chlorine electrode method could satisfactorily determine the concentrations of Cl2 and ClO2 together at pH 7, the chlorophenol red method was needed for the specific determination of ClO2. The chlorite was determined by the specific chlorine electrode at pH 2, and a good correlation was found with the polarographic method which is specific for chloride. The small concentrations of chlorine produced upon disinfection with ClO2 can explain the few chloro-organic materials that were formed. It seems that the chlorine which is produced during disinfection with ClO2 reacts further with some of the organic materials found in the water to produce halogenated organic compounds. (Baker-IVI)
W85-01743

DETERMINATION OF 4-AMINOPHENOL IN WATER BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY WITH FLUORESCENCE DETECTION,
State Chemical Supervision Service, Soeborg (Denmark).
B. Schultz.
Journal of Chromatography, Vol. 299, No. 2, p 484-486, September, 1984. 2 Fig, 8 Ref.

Descriptors: *Water analysis, *Phenols, *Chromatography, *Pollutant identification, *Insecticide, Parathion, Water quality control.

The determination of 4-aminophenol, a metabolite of the insecticide parathion, in water is described using ion pair HPLC and fluorescence detection. Maximum excitation and emission wavelengths for 4-aminophenol were 323 and 373 nm, respectively. Phenol has excitation and emission maxima at 276 and 298 nm, respectively. The detection limit using fuorescence detection of 4-aminophenol was 330 pg. Injection of 100 micro l water sample then gives a detection limit for 4-aminophenol in water corresponding to 3 micro g/l, or 3 ppb. The analysis of tap water and surface water did not show any interference, giving the same detection limits in these media as in Millipore-filter water. Regression analysis showed a linear correlation between the injected amount and the fluorescence intensity for 4-aminophenol in the range 0.3-3 ng. A relative standard deviation of 0.4% was obtained for direct determination of 4-aminophenol at a concentration of 5 micro g/l in tap water. (Baker-IVI)
W85-01746

QUANTITATIVE DETERMINATION OF PPB LEVELS OF CARBAMATE PESTICIDE IN WATER BY CAPILLARY GAS CHROMATOGRAPHY,
New York State Coll. of Human Ecology, Ithaca. Dept. of Design and Environmental Analysis.
W. Z. Zhong, A. T. Lemley, and J. Spalik.
Journal of Chromatography, Vol. 299, No. 1, p 269-274, September, 1984. 2 Fig, 2 Tab, 9 Ref.
EPA grant R809867.

Descriptors: *Water analysis, *Pesticides, *Carbamates, *Aldicarb, *Chromatography, Water quality control, Drinking water, Wells, Surface waters.

A new gas chromatographic method is reported for the quantification of aldicarb and its oxidative metabolites. The method has also been modified for quantification of carbofuran, oxamyl and methomyl. An open tubular column and a nitrogen phosphorus detector are used to quantify nanogram levels of aldicarb, aldicarb sulfoxide and aldicarb sulfone in a one injection procedure. Linear calibration curves are obtained for each species. The method is particularly useful for environmental sampling and for degradative studies in soil-water systems in the laboratory since all three metabolites can be determined in one sample. A typical chromatogram of a mixture contaning 2 micro g/ml each of aldicarb, aldicarb sulfoxide and aldicarb sulfone is shown. By comparing peak areas obtained from injections of the individual compounds to those obtained from the mixture, it is shown that there is no evidence of oxidation of the aldicarb or aldicarb sulfoxide to the next metabolite under the experimental conditions described. The amount recovered by the extraction procedure for each metabolite in four standard aqueous solutions in both distilled water and well water ranging in concentration from 5 to 20 ppb was 96 to 105%. The high recoveries of aldicarb can only be achieved with slow evaporation of the solvent extract at a temperature less than 40 C. The extraction procedure permits analysis of water samples with concentrations of aldicarb and its metabolites as low as 1 ppb. (Baker-IVI)
W85-01747

DETERMINATION OF ALDICARB AND ITS DERIVATIVES IN GROUNDWATERS BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY WITH UV DETECTION,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
C. J. Miles, and J. J. Delfino.
Journal of Chromatography, Vol. 299, No.1, p 275-280, September, 1984. 2 Fig, 2 Tab, 14 Ref.

Descriptors: *Water analysis, *Aldicarb, *Pesticides, *Chromatography, Water quality control, Pollutant identification.

The method presented allows rapid and precise determination of aldicarb and several of its derivatives in groundwater down to the micro g/l or nanogram level without sample pretreatment. UV spectra of aldicarb and its derivatives showed the maximum absorption wavelengths to range from 197 to 203 nm with the exception of aldicarb sulfone nitrile. A chromatogram of four aldicarb derivatives separated isocratically with a mobile phase of acetonitrile-water on a Zorbaxoctyl stationary phase is shown. Standard curves for the compounds tested were linear over the range examined and squares of the correlation coefficients for four-point standard curves were very good. Limits of detection for the three carbamyl oximes and their oximes were approximately 10 micro g/l or 2 ng each. Detection of aldicarb sulfone nitrile can be vastly improved by decreasing the wavelength of detection, however, increased absorption of interferences and mobile phase limit the usefulness of this modification. Reversed-phase HPLC with UV detection proved a useful method for the rapid determination of aldicarb and its derivatives in aqueous samples down to the micro g/l or nanogram level. Two isocratic runs were used to separate all the aldicarb compounds in a reasonable time, although solvent programming could decrease total analysis time. No sample pretreatment was needed which allowed rapid and precise measurements of degradation of aldicarb, aldicarb sulfoxide, and aldicarb sulfone in groundwater microcosms. (Baker-IVI)
W85-01748

HEAVY METALS IN ULVA LACTUCA COLLECTED WITHIN TOLO HARBOUR, AN ALMOST LANDLOCKED SEA,
Chinese Univ. of Hong Kong, Shatin. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W85-01762

EFFECTS OF PHOSPHATE FERTILIZER APPLICATIONS AND CHEMISTRY-MINERALOGY OF THE IRON OXIDE SYSTEM ON PHOSPHATE ADSORPTION-DESORPTION BY STREAM SEDIMENTS,
Ohio State Univ., Columbus. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W85-01794

METAL SPECIATION IN SURFACE WATERS OF THE GREAT LAKES REGION,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
J. P. Giesy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-190396, Price codes: A04 in paper copy, A01 in microfiche. Institute of Water Research Completion Report, September 1983. 60 p, 9 Fig, 5 Tab, 130 Ref. Project No. OWRT A-121-MICH(1), Contract/Grant No. 14-34-0001-2124.

Descriptors: *Uranium, *Trace metals, Computer model, Ion exchange, Chemical reactions, Dynamics, Humic acids, Chemical analyses, *Stability constants, Model studies, Thermodynamics, Laser fluorometry, Scatchard analyses, Gaussian model, Prediction.

Predicting the dynamics of trace metals such as uranium by thermodynamic prediction models is contingent upon accurate stability constants. Conditional stability constants (K') for the binding of uranyl ion (UO_2^{2+}) to humic substances were determined by both Scatchard analyses and by fitting the data to a Gaussian model of multiple sites. UO_2^{2+} was separated from that which was bound to humic material by ion exchange. Uranium concentration was measured by laser fluorometry. There is a broad range of strengths of sites such that K' was dependent on the UO_2^{2+} humic ratio. The maximum binding capacity of the humic material was 4.83 x 10 to the minus 4th power M/g. The log K' determined for log metal/ligand ratios of -1.5 to -0.5, the ecologically significant range of interest for UO_2^{2+}, which was from 10 - 50 micrograms/l at the carbon concentration of 2.36 mg/l used in this study, was determined by Scatchard analysis to be 7.38. The estimate based on a Gaussian distribution was 6.85. W85-01811

FLUORIDE, NITRATE, AND DISSOLVED-SOLIDS CONCENTRATIONS IN GROUND WATERS OF WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01828

HEPATIC MIXED-FUNCTION OXIDASES IN CALIFORNIA FLATFISHES ARE INCREASED IN CONTAMINATED ENVIRONMENTS AND BY OIL AND PCB INGESTION,
Lawrence Livermore National Lab., CA.
R. B. Spies, J. S. Felton, and L. Dillard.
Marine Biology, Vol. 70, No. 2, p 117-127, September, 1982. 6 Fig, 5 Tab, 45 Ref. DOE contract W-7405-Eng-48 and EPA contract EPA-IAG-D6-E681-CF.

Descriptors: *Oil pollution, *Polychlorinated biphenyls, *Flatfish, *California, *Monitoring, *Mixed-function oxidases, Water pollution effects, Coastal areas, Enzymes, Effluents, Fish, Adaptation.

Hepatic mixed-function oxidases (MFOs) were measured in the bothid flatfishes Citharicthys sordidus and C. stigmaeus from relatively uncontaminated and from polluted coastal populations of California, USA, at various times of the year during 1979-1980 and in individuals fed crude oil and polychlorinated biphenyl-augmented food in the laboratory. For C. sordidus, aryl hydrocarbon hydrocylase (AHH) specific activity was generally highest around the Los Angeles County sewage outfall on the Palos Verdes Shelf, intermediate near the 7-mile Hyperion sewage outfall in Santa Monica Bay and around a petroleum seep in the Santa Barbara Channel, the lowest in relatively unpolluted Monterey Bay. For C. stigmaeus, which had about ten times less specific activity than the foregoing species, specimens from the Santa Barbara petroleum seep had significantly greater AHH specific activity than those from Monterey Bay. Fishes from contaminated environments also showed increases of microsomal proteins with molecular weights of 56, 54, 57, and 46 x 10 to the 3rd; moreover, the content of cytochrome P-450 was elevated in specimens of C. sordidus from such environments. Augmentation of food with seep oil or polychlorinated biphenyls (PCBs) induced significant increases in the specific activity of AHH and amounts of microsomal proteins in C. stigmaeus. Thus, these two species of flatfishes are good candidates for monitoring biologically meaningful levels of petroleum and polychlorinated biphenyls in contaminated environments. Moreover, the mixed function oxidase pattern in fish populations from the Santa Barbara petroleum seep is evidently a functional adaption to chronic intake of petroleum hydrocarbons. (Author's abstract)
W85-01894

MYTILUS GALLOPROVINCIALIS AND PARAPENAEUS LONGIROSTRIS AS BIOINDICATORS OF HEAVY METAL AND ORGANOCHLORINE POLLUTION,
Institute of Oceanographic and Fisheries Research, Athens (Greece).
J. Satsmadjis, and F. Voutsinou-Taliadouri.
Marine Biology, Vol. 76, No. 2, p 115-124, November, 1983. 1 Fig, 6 Tab, 31 Ref.

Descriptors: *Bioindicators, *Mussels, *Shrimp, *Heavy metals, *Chlorinated hydrocarbons, *Saronikos Gulf, *Greece, Seasonal variation, Sampling, Marine environment.

The mussel Mytilus galloprovincialis and the shrimp Parapanaeus longirostris were evaluated as bioindicators for pollution by heavy metals (Fe, Zn, Cu, Pb, Mn, Ni, Cd, Cr, Co) and chlorinated hydrocarbons (PCBs, p,p'DDE, p,p'DDT, p,p'DDD, BHCs, heptachlor epoxide, dieldrin, endrin). The accuracy of the determinations, the spot and area variability, the overall coefficient of variation, the effect of the season and the size, the differences observed in four sections of the Saronikos Gulf (Greece) for P. longirostris, and the degree of pollution, which was estimated independently by measuring the concentration in the water of nutrients and dissolved oxygen. The organisms can be used as bioindicators of pollution. The individual variability of response, the season and the size do not cause as much assessment error as the large temporal fluctuations and the frequent inadequacies of the analytical procedures. A truly representative sample can be collected by selecting a definite specimen size range, and collecting the organisms over a three month period in an area of uniform salinity and at the same depth. (Moore-IVI)
W85-01899

SPATIAL AND TEMPORAL TRENDS IN HEAVY METAL CONCENTRATIONS IN MUSSELS FROM NORTHERN IRELAND COASTAL WATER,
Queen's Univ., Belfast (Northern Ireland). Dept. of Agricultural and Food Chemistry.
N. F. S. Gault, E. L. C. Tolland, and J. G. Parker.
Marine Biology, Vol. 77, No. 3, p 307-316, December, 1983. 8 Fig, 7 Tab, 29 Ref.

Descriptors: *Bioindicators, *Heavy metals, *Mussels, *Northern Ireland, Coastal waters, Spatial distribution, Temporal distribution, Mercury, Chromium, Water pollution effects, Marine environment.

Data are presented on the heavy metal concentrations in mussels, Mytilus edulis (L), sampled over a 1 yr period (August 1980-August 1981) from Northern Ireland coastal waters. The study was aimed at investigating the spatial extent and temporal trends in heavy metal contamination and highlighting any areas with exceptionally high levels of toxic metals. With the exception of two sites with high values for mercury and chromium, respectively, contamination by metals was relatively low. Significant spatial and temporal differences in the concentrations of several metals were found. There were also significant spatial x temporal interactions for all metals studied. Significant negative correlations between the percentage dry matter content of mussels and the concentrations of several metals were found. There were also significant positive correlations between certain pairs of metals. It is proposed that small variations in contamination of the marine environment can be detected by subtle differences in the concentration of metals in mussels and that mussel condition may be adversely affected by metal contamination. (Author's abstract)
W85-01901

BIOAVAILABILITY OF PB AND ZN FROM MINE TAILINGS AS INDICATED BY ERYTHROCYTE DELTA-AMINOLEVULINIC ACID DEHYDRATASE (ALA-D) ACTIVITY IN SUCKERS (PISCES: CATOSTOMIDAE),
Columbia National Fisheries Research Lab., MO.
C. J. Schmitt, F. J. Dwyer, and S. E. Finger.
Canadian Journal of Fisheries and Aquatic Science, Vol. 41, No. 7, p 1030-1040, 1984. 3 Fig, 4 Tab, 38 Ref.

Descriptors: *Suckers, *Enzymes, *Lead, *Zinc, *Bioavailability, *Mine wastes, Heavy metals, Cadmium, Bioassay, Blood, Statistical models, Fish.

The activity of the erythrocyte enzyme delta-aminolevulinic acid dehydratase (ALA-D) was meas-

ured in 35 catostomids (black redhorse, Moxostoma duquesnei; golden redhorse, M. erythrurum; northern hogsucker, Hypentelium nigricans) collected from three sites on a stream contaminated with Pb-, Cd-, and Zn-rich mine tailings and from an uncontaminated site upstream. Enzyme activity was expressed in terms of hemoglobin (Hb), DNA, and protein concentrations; these variables can be determined in the laboratory on once-frozen blood samples. Concentrations of Pb and Zn in blood and of Pb in edible tissues were significantly higher, and ALA-D activity was significantly lower, at all three contaminated sites than upstream. At the most contaminated site, ALA-D activity was 62-67% lower than upstream. Lead concentrations in the edible tissues and in blood were positively correlated ($r = 0.80$), whereas ALA-D activity was negatively correlated with Pb in blood ($r = -0.70$) and in edible tissues ($r = -0.59$). Five statistically significant relations between Pb and Zn in blood and ALA-D activity were determined. The two models that explained the highest percentage (> 74%) of the total variance also included factors related to Hb concentration. All five significant models included negative coefficients for variables that represented Pb in blood and positive coefficients for Zn in blood. The ALA-D assay with results standarized to Hb concentration represents an expedient alternative to the more traditional hematocrit standardization, and the measurement of ALA-D activity by this method can be used to document exposure of fish to environmental Pb. (Author's abstract)
W85-01918

ESTIMATES OF DISSOLVED AND SUSPENDED SUBSTANCE YIELD OF STREAM BASINS IN MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
T. R. Cummings.
USGS Water-Resources Investigations Report 83-4288, 1984. 57 p, 4 Fig, 5 Tab, 2 Ref.

Descriptors: *Water quality, *River basins, Streams, *Hydrologic data networks, *Regression analysis, Yield equations, *Great Lakes, *Michigan.

Water-quality data collected at 20 stations in Michigan were used to develop regression equations relating discharge to loads of 19 dissolved and suspended substances measured at each station. These equations and mean daily discharge were used to estimate long-term loads, which then were converted to estimates of drainage basin yields. These yields were compared to measured yields and to previous estimates. Fifty percent of the equations had standard errors of 22 percent or less; 90 percent had standard errors of 80 percent or less. Regression exponents indicate that the load increases as discharge increases in all cases, but for about two-thirds of the substances or properties the increase is less rapid than that of discharge. Seventy-eight percent of the nitrogen, phosphorus, and sediment loads, taken as a group, increase more rapidly than discharge. With respect to concentration, about 63 percent of the substances or properties decrease as discharge increases.
W85-01942

PESTICIDE AND PCB LEVELS IN FISH FROM ALBERTA (CANADA).
Alberta Environmental Centre, Vegreville.
Chemosphere, Vol. 13, No. 1, p 19-32, 1984. 2 Fig, 3 Tab, 12 Ref.

Descriptors: *Pollutant identification, *Alberta, *Pesticides, *Fish, *Polychlorinated biphenyls, Organic compounds, Path of pollutants.

Concentrations of 43 pesticides and PCB's were determined in muscle and fat samples of 750 fish collected from 11 lakes and rivers in Alberta. Of the 43 compounds tested for, evidence was found for only 12. Although phenoxy and organophosphate residues were always below detectable limits, traces of chlorinated pesticides and their derivatives, particularly DDE, DDD and chlordane, were detected in most fat samples. Methoxychlor was frequently found in goldeye from the North Saskatchewan River but not recorded in fish from any other lake or river. Its presence in goldeye, a highly migratory species, was probably a result of biting-fly control programs in the Saskatchewan part of the river. PCB levels exceeded 25 mg/kg in the fat of several species from the North Saskatchewan River but were generally lower in the other systems. Analysis of 160 sediment samples from the North Saskatchewan River revealed no point source of PCB contamination, with residues always less than 0.01 mg/kg dry weight. As a result, residues in the muscle tissue of fish were also relatively low compared to other industrialized areas. (Baker-IVI)
W85-01954

IDENTIFICATION OF NONIONIC DETERGENTS BY GC/CI-MS: I. A COMPLEMENTARY METHOD OR AN ATTRACTIVE ALTERNATIVE TO GC/EI-MS AND OTHER METHODS,
Stanford Univ., CA. Dept. of Civil Engineering.
E. Stephanou.
Chemosphere, Vol. 13, No. 1, p 43-51, 1984. 8 Fig, 2 Tab, 19 Ref. National Science Foundation Grant No. CEE-81-1756.

Descriptors: *Pollutant identification, *Wastewater analysis, *Organic compounds, *Chemical ionization mass spectra, *Detergents, Alkylphenol ethoxylates, Alcohol ethoxylates.

Chemical ionization (CI) mass spectra was used to identify tertiary octylphenol and lauryl alcohol ethoxylates with one to six oxyethylene groups in the effluent from the primary clarifiers of a Palo Alto wastewater treatment plant. This plant provides secondary treatment with trickling filters and activated sludge processes in series, and filtration prior to effluent chlorination. In lab studies technical grade tertiary octylphenol ethoxylates and lauryl alcohol ethoxylates were dissolved in methylene chloride to give a concentration of 1.5-2 mg/ml. Both products are nonionic detergents with an average number of oxyethylene groups of 5-6. The methane CI induced mass spectra of the tertiary octylphenol ethoxylates gives very reliable information on the molecular weight of the compounds because of the presence of the adduct ions $(MH)+$ and $(MC2H5)+$. These ions are subsequently fragmented to the ions $(MH-112)+$ and $(MC2H5-112)+$ (olefin displacement), which allows determination of the length of the oxyethylene chain. The alkyl ion displacement gives information about the alkyl substituent of the phenolic ring. The mass chromatograms show that a selective detection of these surfactants, using their CI mass spectra, is very appropriate for routine procedures. (Baker-IVI)
W85-01955

AQUATIC LEECHES (HIRUDINEA) AS BIOINDICATORS OF ORGANIC CHEMICAL CONTAMINANTS IN FRESHWATER ECOSYSTEMS,
Canada Centre for Inland Waters, Burlington (Ontario).
J. L. Metcalf, M. E. Fox, and J. H. Carey.
Chemosphere, Vol. 13, No. 1, p 143-150, 1984. 3 Tab, 14 Ref.

Descriptors: *Fate of pollutants, *Bioindicators, *Leeches, *Ganagagigue Creek, Ontario, Domestic wastes, Industrial wastes, *Organic compounds, Chlorinated hydrocarbons, Chlorophenols.

Ganagagigue Creek is a minor tributary of the Grand River which in turn empties into Lake Erie. It receives domestic and industrial sewage effluent from the town of Elmira, Ontario, as well as leachates from a disused chemical waste dump. The latter appears to be the principal source of chlorinated contamination of the creek. Freshwater leeches from the creek contain very high residues of chlorophenols, being one to two orders of magnitude greater than levels found in fish, tadpoles and most other benthic invertebrates. Only aquatic oligochaetes, which are a class of annelids closely related to leeches, had comparable residues. Of the four leech species, Dina dubia appears to be the best bioinidicator on the basis of its high bioaccumulation potential for chlorophenols. It is an uncommon, geographically restricted species about which little is known. Erpobdella punctata, Glossiphonia complanata and Helobdella stagnalis are all common and widespread in North America and their use would permit comparisons among areas which are widely separated geographically. (Baker-IVI)
W85-01958

ADSORPTION OF SURFACTANTS ON SEDIMENTS,
Yokohama National Univ. (Japan). Dept. of Safety and Environmental Engineering.
K. Urano, M. Saito, and C. Murata.
Chemosphere, Vol. 13, No. 2, p 293-300, 1984. 10 Fig, 5 Tab, 5 Ref.

Descriptors: *Fate of pollutants, *Adsorption, *Isotherms, *Surfactants, Rivers, Sediments, River sediments.

Surfactants are abundantly used for a wide range of industrial and domestic uses, and they are discharged into wastewater, which in turn contaminates the water environment. Adsorption isotherms of 5 priority surfactants on 7 river sediments were obtained and discussed for presumption of the fate of surfactants in water environment. The adsorption abilities of the sediments seemed to be independent of the surface area and to be related to the organic carbon contents. The surfactants were ready to adsorb in the same order as their adsorption on microorganisms. The adsorbed amounts per gram of the organic carbon in the sediments were nearly equal for most of the sediments studied. (Baker-IVI)
W85-01960

METHOD FOR TOTAL ORGANIC CHLORINE DETERMINATION IN BLEACH PLANT RECIPIENT WATERS,
Abo Akademi, Turku (Finland). Lab. of Forest Products Chemistry.
J. Hemming, and B. Holmbom.
Chemosphere, Vol. 13, No. 4, p 513-520, 1984. 2 Fig, 6 Tab, 12 Ref.

Descriptors: *Pollutant identification, *Organic compounds, *Chlorine, *Industrial wastes, Bleach, Particle Induced X-ray Emission, Resin sorbtion, Water analysis.

A method based on XAD-8 resin sorbtion and Particle Induced X-ray Emission (PIXE) was developed for total organic chlorine (TOCl) determinations in diluted water solutions with special emphasis on bleach plant effluents/recipients. PIXE offers a fast and sensitive method for multielemental analysis. The major advantages compared to usual methods for halogen determinations are that no conversion of organo-halogen into halogen-ions is needed and that PIXE discriminates between the different halogens. The method was applied to recipient waters of a kraft bleach plant, and the determined TOCl values were compared with other parameters. The detection limit was about 10 micro g/liter. (Baker-IVI)
W85-01962

WATER QUALITY OF LAKE ARLINGTON ON VILLAGE CREEK, NORTH-CENTRAL TEXAS, 1973 TO 1981,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2H.
W85-02042

STANDARDIZATION OF METHODS OF ANALYSIS FOR HEAVY METALS IN SEDIMENTS,
Institute for Soil Fertility, Groningen (Netherlands).
A. J. de Groot, K. H. Zschuppe, and W. Salomons.
Hydrobiologia, Vol. 92, p 689-695, July, 1982. 2 Fig, 2 Tab, 14 Ref.

Descriptors: *Heavy metals, *Sediment analysis, Sampling, Sample preparation, Chemical analysis, X-ray fluorescence, Neutron activiation analysis, Water pollution sources.

In studies of heavy metals in sediments, there is a need for standardization of the procedures for sample collection and preservation, chemical analyses and presentation of results. The method and depth of sampling depend on the aim of the investigation and on local sediment conditions, such as consistency of the sediment, rate of sedimentation, diagnetic processes and bioturbation. Therefore no general recommendations can be given in this respect. During collection and preservation, contamination and loss of constituents must be avoided. In sediments, the best means for estimating total contents of metals is digestion with HF, in combination with strong acids. Other methods include X-ray fluorescence and neutron activation analyses. The use of HF is considered objectionable by some laboratories. A reasonable alternative is aqua regia. Because variations in granular composition affect metal contents, it is advisable to use the fraction < 63 micro m for the analysis. Chemical partition of sediments provides an insight into the source of metallic constituents, and their pathways to deposition areas. A three-step extraction procedure, in the sequence 0.1 M hydroxylamine-HCl, H2O2 30% and HF, is proposed. Finally, attention is paid to the anthropogenic enrichment of metals in sediments. The establishment of baseline levels is discussed. (Author's abstract)
W85-02104

CHEMICAL DERIVATIZATION ANALYSIS OF PESTICIDE RESIDUES. VIII. ANALYSIS OF 15 CHLOROPHENOLS IN NATURAL WATER BY IN SITU ACETYLATION,
Canada Centre for Inland Waters, Burlington (Ontario).
H.-B. Lee, L.-D. Weng, and A. S. Y. Chau.
Journal of the Association of Official Analytical Chemists, Vol. 67, No. 4, p 789-794, July-August, 1984. 3 Fig, 4 Tab, 8 Ref.

Descriptors: *Pesticide residues, *Chlorophenols, *Gas chromatography, Natural waters, Chemical analysis, Phenols.

In the presence of KHCO3, phenols in water are acetylated by acetic anhydride directly without pre-extraction. The resultant acetates are extracted by petroleum ether and analyzed by electron capture gas chromatography. This method is simple and involves no more steps than a method which requires no derivatization. The major advantages of the method are that phenol acetates are much easier to recover from water samples and they are also easier to chromatograph on gas chromatography columns than free phenols. The method applies to the di-, tri-, tetra-, and pentachlorophenols in natural waters from 100 to 0.01 ppb with 1 L water sample. (Moore-IVI)
W85-02113

DETERMINATION OF PHENOLS IN WATER USING RAMAN SPECTROSCOPY,
Florida State Univ., Tallahassee. Dept. of Chemistry.
N. A. Marley, C. K. Mann, and T. J. Vickers.
Applied Spectroscopy, Vol. 38, No. 4, p 540-543, July/August, 1984. 4 Tab, 16 Ref. NOAA contract NA82AA-D-00012.

Descriptors: *Phenols, *Raman spectroscopy, *Water analysis, Chlorophenols, Spectroscopy.

The potential of Raman spectroscopy for quantitative analysis of phenols in water solution has been investigated. A group of six compounds - phenol, o-chlorophenol, 2,4-dichlorophenol, 2,4,6-trichlorophenol, 2-chloro-5-methylphenol and 2-chloro-4-nitrophenol - was studied with the use of the 514.5, 488.0, and 457.9 nanometer lines of an argon ion laser. Attention was given to the effects of source intensity, optical alignment, and background fluctuations on quantitative results. It was found that the use of an internal standard with each measurement made a significant improvement in the accuracy and precision of results. Two methods of quantitation, peak area measurement and cross-correlation, were used. Results were somewhat better for cross-correlation, presumably because of more effective exclusion of background interference. Limits of detection were calculated based upon the slope and the standard deviation of the intercept of the standard curve. These varied from the range of 100 ppm to 0.3 ppm, depending on the compound. The most important factor controlling sensitivity is occurrence of resonance enhancement. (Author's abstract)
W85-02114

SIMULTANEOUS DETERMINATION OF PARTITION COEFFICIENTS AND ACIDITY CONSTANTS OF CHLORINATED PHENOLS AND GUAIACOLS BY GAS CHROMATOGRAPHY,
Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Analytical and Marine Chemistry.
T. M. Xie, and D. Dyrssen.
Analytica Chimica Acta, Vol. 160, p 21-30, June, 1984. 2 Fig, 1 Tab, 26 Ref.

Descriptors: *Partition coefficients, *Acidity constants, *Gas chromatography, *Chlorinated phenols, *Guaiacols, Phenols, Organic compounds, Hydrogen ion concentration.

The partition coefficients, P, of organic compounds in the n-octanol/water system have been used for the assessment of bioaccumulation potential and the distribution pattern of organic pollutants. The partition coefficients, P, in the n-octanol/water system and the acidity constants, Ka, of 15 chlorinated phenols and guaiacols at 20 degrees were simultaneously determined by investigating the pH dependence of the apparent partition coefficients, Pa. For determining Pa, the relative responses of individual phenols and guaiacols in the aqueous phase after equilibration were measured by glass-capillary gas chromatography with electron-capture detection and compared with those in the octanol phase before partition. Curve-fitting, linear regression, and non-linear regression were used for treating the partition data. The present pKa values of chlorinated phenols and guaiacols are determined simultaneously; thus the surrounding conditions are more nearly identical than in other methods in which the determinations must be done individually. This means that these values may represent a more correct relative relation, which is important in studies of the distribution of these compounds in the environment. In this method, only <1-mg amounts of substance are needed for the pKa determination with an accuracy of 0.1 pKa units, and the purity of the substances is not critical if the impurity separates form the main peak. (Moore-IVI)
W85-02115

ORGANIZATION AND EVALUATION OF INTERLABORATORY COMPARISON STUDIES AMONG SOUTHERN AFRICAN WATER ANALYSIS LABORATORIES,
National Inst. for Water Research, Pretoria (South Africa).
R. Smith.
Talanta, Vol. 31, No. 7, p 537-545, July, 1984. 3 Fig, 5 Tab, 31 Ref.

Descriptors: *Water analysis, *Wastewater analysis, *South Africa, Interlaboratory comparisons, Quality control, Statisitical analysis, Standards.

Interlaboratory comparison studies provide a useful 'external' supplement to the various 'internal' quality-control procedures which must be employed in the water-analysis laboratory in order to maintain a high degree of reliability in the production of analytical results. Such studies have been made regularly for many years by various overseas organizations, and were introduced in South Africa in 1976. Since that time 16 studies have been made, involving more than 40 laboratories. In this paper the various factors involved in the successful organization of interlaboratory comparison studies are discussed, and details are given of the sample-preparation, analysis-instruction and result-reporting procedures used in the southern African studies. Techniques used for the statistical evaluation of the analytical results submitted are described and discussed, for example, methods for the rejection of outliers, measures of accuracy and precision, determination of total error, tests of significance. Greenberg's assessment technique, Madden's ranking technique and Youden's graphical technique. A brief review is given of the studies made to date, along with specific findings and recommendations arising from them. The need for a recognized updated set of standard methods for use by water and wastewater analysis laboratories in southern Africa is highlighted.
W85-02117

EVALUATION OF ELECTRODE METHODS FOR DETERMINING TOTAL RESIDUAL CHLORINE IN VARIOUS WATER MATRICES,
Benedict Coll., Columbia, SC. Dept. of Chemistry.
For primary bibliographic entry see Field 7B.
W85-02123

SIMULTANEOUS CONCENTRATION OF FOUR ENTEROVIRUSES FROM TAP, WASTE, AND NATURAL WATERS,
Hadassah Medical School, Jerusalem (Israel). Environmental Health Lab.
N. Guttman-Bass, and A. Nasser.
Applied and Environmental Microbiology, Vol. 27, No. 6, p 1311-1315, June, 1984. 5 Tab, 18 Ref. EPA grant R 806588010.

Descriptors: *Enteroviruses, *Drinking water, *Wastewater analysis, *Natural waters, *Israel, Jerusalem, Lake Kinneret, Mediterranean, Coxsackie virus, Poliovirus, Echovirus, Water analysis, Virus recovery, Concentration methods.

The efficiency of virus recovery from water was investigated by using a method which enabled the concentration of a mixture of four enteroviruses with determination of their individual recovery efficiencies. The four viruses used (poliovirus 1, coxsackievirus A9, coxsackievirus B1, and echovirus 7) represented each of the four major subgroups of enteroviruses. This method, which was based on selective antibody neutralization, was used to investigate the effects of input water quality on enterovirus concentration by Balston filters (grade C; Balston, Inc., Lexington, Mass.) and organic flocculation. With tap water, the average recovery efficiency of the four viruses was 97%. Concentration from natural waters, including samples from two lakes (Lake Kinneret and the Hula Nature Reserve) and the Mediterranean Sea, resulted in similarly high average recovery efficiencies. Echovirus 7 was recovered with a slightly lower average efficiency from these types of water than were the other viruses. In comparison with other types of water, virus concentration from Jerusalem wastewater generally had a slightly lower efficiency of recovery, ranging from 63 to 75% for each of the viruses, with an overall average of 68%. The ability of each concentration step, membrane filtration or organic flocculation, to recover the viruses from water was assayed. For the filtration step, although there were not large differences in virus recoveries from tap water, echovirus 7 was recovered with the lowest efficiency (72%), and poliovirus 1 was recovered with the highest (87%) efficiency. Overall virus recovery by the filtration step was least efficient for wastewater (73%) and most efficient for seawater (107%). The organic flocculation step was highly efficient, with essentially all of the virus recovered either as individual viruses or as a mixture. Of the types of water tested, viruses were recovered from seawater with the lowest efficiency. In summary, although some differences in virus recovery were observed for various types of water and individual viruses, the range was not large. Thus, the two-step concentration method used was found to be an efficient general method for enterovirus concentration from water. (Author's abstract)
W85-02137

5B. Sources Of Pollution

GROUNDWATER QUALITY SURVEY OF AN UNSEWERED, SEMI-RURAL AREA,

Ministry of Works and Development, Christchurch (New Zealand).
L. W. Sinton.
New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 3/4, p 317-326, 1982. 4 Fig, 1 Tab, 35 Ref.

Descriptors: *Christchurch, *New Zealand, *Groundwater pollution, *Water quality, *Well water, Septic tanks, Ammonia, Nitrates, Chlorides, Coliforms, Sewage bacteria, Streptococcus, Bacteria, Conductivity.

A baseline groundwater quality survey of 120 household wells in an unsewered area at Yaldhurst, near Christchurch (New Zealand), was carried out between September and December, 1976. Ammonia-N levels were below the detection limit (0.02 g/cu m) in all samples. Nitrate-N, conductivity, and chloride levels tended to vary according to well depth and location, being lower in the deeper wells and in wells located in an area of shallow, stony soils. Approximately 33% of the wells contained coliform bacteria, fecal coliform bacteria or fecal streptococci. A subset of 25 wells was sampled fortnightly from January to August 1977. From January to June, mean nitrate-N and conductivity levels remained stable at approximately 1.5 g/cu m and 11.2 mS/m respectively. An increase in these levels to 3.3 g/cu m and 15.8 mS/m in July-August corresponded with a rise in the water table. Leaching losses from soils probably accounted for most of the nitrate entering the Yaldhurst aquifers, the contribution by septic tank systems being estimated at 20-30%. No direct evidence of contamination of the wells by septic tank effluent was found, although 23 of the 25 wells exhibited intermittent contamination by indicator bacteria throughout the 8 month sampling program. Although a localized health hazard may exist, septic tank systems in the area were not considered likely to constitute a health threat to the confined aquifers underlying Christchurch city. (Author's abstract)
W85-01633

WATER QUALITY OF THE WAIOHEWA STREAM, ROTORUA,

Ministry of Works and Development, Hamilton (New Zealand). Water and Soil Science Centre.
R. B. Williamson, and J. G. Cooke.
New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 3/4, p 327-337, 1982. 4 Fig, 5 Tab, 32 Ref.

Descriptors: *Waiohewa Stream, *Rotorua, *New Zealand, *Water quality, Nitrogen, Ammonia, Boron, Arsenic, Nitrates, Mercury, Geothermal resources.

The chemical quality of the Waiohewa stream, Rotorua (New Zealand), was assessed from the results of 2 longitudinal surveys in summer 1978-79. In particular, changes in nitrogen concentration were examined. The quantity of ammonia increased downstream from unmonitored geothermal inputs, but, after dilution and neutralization by a larger inflow of freshwater, considerable proportions of ammonia were converted to nitrate. In the first survey ammonia concentrations decreased from 4.48 to 2.47 g/cu m and nitrate concentrations increased from 0.59 to 1.13 g/cu m in a 3-km stretch of the stream. Mass flow calculations show that nitrification could account for at least 55% of the ammonia decrease, the rest probably being lost through assimilation or denitrification. Laboratory incubation experiments showed that nitrification occurred in the stream bed. The geothermal waters contained low concentrations of boron (1.1-4.0 g/cu m), filterable mercury (0.1-0.8 mg/cu m) and arsenic (10-14 mg/cu m). (Author's abstract)
W85-01634

NITROGEN AND PHOSPHORUS IN THE NGONGOTAHA STREAM,

Ministry of Works and Development, Hamilton (New Zealand). Water and Soil Science Centre.
R. A. Hoare.
New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 3/4, p 339-349, 1982. 8 Fig, 4 Tab, 13 Ref.

Descriptors: *Ngongotaha Stream, *New Zealand, *Rotorua, *Nitrogen, *Phosphorus, Base flow, Flood flow, Nitrates, Ammonia, Kjeldahl procedure, Nutrients.

The nitrogen and phosphorus loads of the Ngongotaha Stream, near Rotorua, New Zealand were determined for 1976 and 1977 and a novel way to define a flow-concentration curve was developed. There was a clear distinction between total P concentrations in base flow and in flood flow of the stream. In base flow, the concentrations were independent of flow rate, as well as being low, while in floods the concentrations became very strongly dependent on flow rate. Nitrate, ammonia, dissolved reactive phosphorus (DRP), total phosphorus (TP), and total Kjeldahl nitrogen (TKN) concentrations were measured; mean concentrations in 1976 base flow were found to be 527, 25, 32, 48, and 162 mg/cu m respectively. Nitrate concentrations showed seasonal variations, and although changes occurred during floods, they were not correlated with flow rate. DRP concentrations showed little variation, except that they dropped at the peak of the largest floods. TP was strongly correlated with flow rate during floods, and TP loads could best be calculated by allowing for a curvilinear relationship between concentration and flow rate. The logarithms of the TP load carried by a flood and the peak flow rate of the flood were highly correlated (R = 0.984). The loads of nitrate-N, ammonia-N, DRP, TP, and TKN in 1976 were estimated to be 34, 1.3, 6.0, and 26 tons. (Collier-IVI)
W85-01635

SEASONAL STUDY OF A FRESHWATER LAKE AND MIGRATORY WATERFOWL FOR CAMPYLOBACTER JEJUNI,

Wisconsin Univ.-La Crosse. Dept. of Biology.
G. A. Hill, and D. J. Grimes.
Canadian Journal of Microbiology, Vol. 30, No. 6, p 845-849, June, 1984. 1 Fig, 1 Tab, 32 Ref.

Descriptors: *Lake Onalaska, *La Crosse, *Wisconsin, *Campylobacter, *Waterfowl, Birds, Water Birds, Bacteria, Coliforms, Animal wastes, Streptococcus, Water pollution sources.

Carrier birds may contribute to water-borne transmission of Campylobacter jejuni. Water and sediment samples from Lake Onalaska (Mississippi River navigation pool No. 7), near La Crosse, Wisconsin, were quantitatively examined in the summer and fall of 1981 for C. jejuni and for standard bacterial indicators of fecal pollution. Its location within the Mississippi Flyway makes Lake Onalaska ideally suited as a temporary roosting site for several hundred thousand migratory waterfowl every year. Fifty cecal content samples, representing seven species of transient waterfowl captured during fall migration, were also assayed for C. jejuni. Fecal coliform and fecal streptococcus counts from the water and sediment samples agreed with previously established values for the pool and accurately reflected the influx of approximately 619,000 ducks and geese during fall migration. C. jejuni was not recovered from water, sediment, or fecal samples. This conflicts with previous reports which implied a cosmopolitan distribution of C. jejuni among waterfowl. Chemical and physical analyses of water samples revealed nothing remarkable and certainly offered no explanation for the absence of C. jejuni from Lake Onalaska. Other avian-borne pathogens also exhibit sporadic distribution, influenced by avian feeding habits, season, geographic differences, hunting pressure, intermingling of water fowl with nonaquatic birds and other animals, and farming practices. C. jejuni cannot be regarded as cosmopolitan among migratory waterfowl. (Collier-IVI)
W85-01639

AROMATIC HYDROCARBONS IN WATERS OF PORT PHILLIP BAY AND THE YARRA RIVER ESTUARY,

Melbourne Univ., Parkville (Australia). Marine Chemistry Lab.
J. D. Smith, and W. A. Maher.
Australian Journal of Marine and Freshwater Research, Vol. 35, No. 2, p 119-28, 1984. 4 Fig, 2 Tab, 23 Ref.

Descriptors: *Australia, *Port Phillip Bay, *Yarra River Estuary, *Corio Bay, *Hobsons Bay, *Hydrocarbons, Fluorescence emmission spectroscopy, Oil, Terphenyl, Pyrene, Water pollution sources.

Port Phillip Bay, Australia, is a shipping route with onshore oil refineries and with major ports on Corio Bay (Geelong) and Hobsons Bay (Melborne). In this environment, input of aromatic hydrocarbons from petroleum is likely to be dominant over atmospheric inputs of combustion products, with negligible contribution from biochemical processes. Aromatic hydrocarbons provide a useful indicator for assessing the anthropogenic input of hydrocarbons into rivers and the sea. Water samples were taken from Port Phillip Bay, the Yarra River estuary, and Corio Bay. Determination of aromatic hydrocarbons in these waters, using solvent extraction and fluorescence emission analysis, showed a wide distribution of fuel oils with only a small contribution from crude oil. Oil concentrations were reported as equivalent amounts of m-terphenyl (T) or pyrene (P). Observed concentrations in Port Phillip Bay were generally 0.2-0.3 micro g/L (T) and 0.1-0.2 micro g/L (P), with higher values in Corio Bay and the Yarra River estuary. All areas with elevated levels of aromatic hydrocarbons contained major contributions from refined oils (including lubricating oils); the areas with aromatic hydrocarbon concentrations approaching background levels appeared to have fuel oil as the major source of contamination. (Collier-IVI)
W85-01644

OIL SPILL FOCUSES ATTENTION ON THE PROBLEMS OF A MAN-MADE RECREATIONAL LAKE,

Toledo Univ., OH.
G. F. Bennett, G. R. Kunkle, E. J. Tramer, C. E. Stoops, Jr., and R. H. Scheidel.
Journal of Environmental Systems, Vol. 14, No. 1, p 31-49, 1984-85. 3 Fig, 7 Tab, 13 Ref.

Descriptors: *Holiday Lake, *Williard, *Ohio, *Oil spills, *Water pollution effects, Path of pollutants, Systems analysis, Costs, Cleanup, Fate of pollutants.

When a runaway diesel engine fell into a turntable pit at a railroad maintenance facility, its oil tanks ruptured releasing 4,000 gallons of No. 2 diesel oil that subsequently flowed through sewers to an agricultural stream that led to Holiday Lake, Williard, Ohio, an inland, man-made lake; two days later the lake residents awoke to find 'wall to wall' oil covering the water surface. The oil quickly disappeared, but not the anger of the property owners who sued the railroad for $1.2 million to dredge the oil-containing sediments 'from the lake bottom,' claiming not only that the spill had added oil to the benthic sediments but also chronic pollution from poorly designed and operated wastewater treatment units had impacted the lake. To obtain data for the pending court suit, the defense attorneys assembled a team of scientists and engineers who used a systems approach to evalute the lake, its water quality inputs into it, and impact of the oil on it. (Author's abstract)
W85-01650

DISTRIBUTION AND PERIODICITY OF TOTAL, FAECAL COLIFORM BACTERIA IN AN AQUATIC ECOSYSTEM,

Jawaharlal Nehru Univ., New Delhi (India). Microbiological Lab.
U. S. Bagde, and A. K. Varma.
International Journal of Environmental Studies, Vol. 19, No. 3/4, p 215-220, 1982. 3 Fig, 1 Tab, 20 Ref.

Descriptors: *New Dehli, *India, *Coliforms, *Lakes, *Bacteria, Escherichia coli, Shigella , Salmonella, Vibrio, Public health.

Some strains of Escherichia coli have been recognized as pathogens in recent years and thus E. coli should no longer be considered as just an indicator and nonpathogenic bacterium of fecal pollution. A bacteriological study of the water of a lake at

Jawaharlal Nehru University, New Delhi, was carried out during 1979-80 for the period of one year. The quality of water was assessed to establish the pattern of periodicity and seasonal variations of total and fecal coliform bacteria. Extreme variations were found in the bacterial counts in different samples collected from the lake water, at the same time. There existed a positive correlation between total coliform and faecal coliforms. In addition to the presence of E. coli and A. aerogenes in large numbers in the water, the isolation of pathogenic bacteria, Vibrio, Shigella, and Salmonella, give a definite indication of its fecal pollution. The bacteriological quality of water was much below the recommended standards for recreational and drinking waters. (Collier-IVI)
W85-01675

STOCHASTIC MODEL FOR BOD AND DO IN STREAMS WHEN THE VELOCITY IS RANDOM AND DISTANCE-DEPENDENT,
North Carolina Univ. at Charlotte. Dept. of Mathematics.
A. S. Papadopoulos.
International Journal of Environmental Studies, Vol. 19, No. 3/4, p 263-267, 1982. 5 Fig, 11 Ref.

Descriptors: *Biochemical oxygen demand, *Dissolved oxygen, *Model studies, Mathematical models, Path of pollutants, Wastewater pollution.

In the past, several mathematical models have discussed the pollution caused in rivers and streams by the discharge of organic waste materials. A new model was developed which more realistically predicts the amount of biochemical oxygen demand (BOD) and dissolved oxygen (DO) at any point on a stream. This stochastic model is a random differential equation of the form X(t)=A(t) X(t)=Y(t), t > or = 0, with initial conditions X sub 0=X(0). X(t) is a vector with BOD and DO at a distance t downstream from the pollution source for components. The velocity of the stream is incorporated into the vector A(t) and is random and distance dependent. The inhomogeneous term Y(t) and the initial conditions are random vectors. Therefore, this model contains random initial conditions, random coefficients and random inhomogeneous terms. Simulated trajectories of the BOD and DO were computed with their joint density assumed to be bivariate normal with correlation coeffecient rho and the densities uniform. (Collier-IVI)
W85-01676

INFLUENCE OF RAINFALL CHARACTERISTICS ON THE POLLUTION EMISSION,
DHV Consulting Engineers, Amersfoort (Netherlands).
For primary bibliographic entry see Field 2E.
W85-01697

METHODS FOR CALCULATION OF ANNUAL AND EXTREME OVERFLOW EVENTS FROM COMBINED SEWER SYSTEMS,
Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.
For primary bibliographic entry see Field 2E.
W85-01699

MICROORGANISM SURVIVAL IN AN ICE-COVERED RIVER,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
G. Putz, D. W. Smith, and R. Gerard.
Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 177-186, June, 1984. 9 Fig, 3 Tab, 11 Ref.

Descriptors: *Microorganisms, *Sewage bacteria, *Indicators, *Ice cover, *Slave River, *Northwest Territories, *Survival, Coliforms, Wastewater disposal, Stream pollution, Bacteria, Fate of pollutants, Source of pollutants.

Persistence of microorganisms in rivers represents a complex situation that simultaneously involves both transverse mixing and decay. Microorganism decay characteristics were determined for ice-covered conditions in the Slave River downstream of the Fort Smith, Northwest Territories, wastewater disposal site. The Fort Smith wastewater treatment and disposal system consists of two primary lagoon cells and a facultative cell, followed by a continuous discharge to the Slave River through a submerged near-shore outfall. Microorganism sampling and analyses for total and fecal coliforms were conducted for each sampling station. After accounting for the physical dilution the limited data showed a barely discernible microorganism die-off within the study reach for the ice-covered conditions. These conditions generally represent periods in which indicator bacteria concentrations persist the longest owing to low water temperatures, isolation from sunlight, and minumum river flow conditions. (Collier-IVI)
W85-01708

MIXING ZONE STUDIES IN THE GRAND RIVER BASIN,
Gore and Storrie Ltd., Toronto (Ontario). Water Resources Div.
T. P. H. Gowda, and L. E. Post.
Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 204-216, June, 1984. 8 Fig, 7 Tab, 11 Ref.

Descriptors: *Mixing zone, *Path of pollutants, *Grand River Basin, *Ontario, *Speed River, Zone of passage, Wastewater treatment, Ammonia, Chlorine, Water quality management.

In a stream that receives wastewater effluent, provincial water quality objectives require maintenance of a specific portion of the cross section of the stream termed the 'zone of passage' (ZOP) wherein the concentrations of the pollutants comply with a specified water quality objective. A steady state mathematical model based on the 'stream tube' concept was utilized to evaluate the impact of various viable management options on the mixing zone boundaries for nonionized ammonia and total residual chlorine at the Grand River below Waterloo, Kitchener, and Galt (Ontario), and the Speed River below Guelph (Ontario). The options evaluated as part of the Grand River Basin Water Management Study include various river flows and effluent flows projected for the planning period 1981-2031. The predictions indicate that a ZOP equal to 60% of river flow is attainable for chlorine in all cases except in the Speed River below Guelph beyond the year 2001, and in-plant nitrification is required at Waterloo and Kitchener under the present conditions in order to comply with the objective for nonionized ammonia. At Guelph, with in-plant nitrification, the ammonia objective will not be met for existing and future summer conditions and for winter conditions beyond the year 2001. For Galt, the ammonia objective is met with conventional secondary treatment under all options. (Collier-IVI)
W85-01710

BEACH FECAL COLIFORMS,
Gore and Storrie Ltd., Toronto (Ontario).
M. D. Palmer, and R. J. Dewey.
Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 217-224, June, 1984. 7 Fig, 3 Tab, 1 Append.

Descriptors: *Coliforms, *Beaches, *Ottawa River, *Ontario, Model studies, Water quality management, Rainfall-runoff relationships, Prediction, Cost analysis, Offshore momentum diffuser, Piers.

The urban beach on the Ottawa River at Britannia, in the city of Ottawa, has been closed periodically by health officials for fecal coliform levels in excess of 100 counts/100 mL. These events were generally related to rainfall events. A combination of the STORM runoff model and a two-dimensional dynamic lake type model successfully reproduced the fecal coliform levels of the beach. Elevated fecal coliform levels were associated with rainfall events and runoff from two large catchments upstream of the beach. Due to prevailing conditions in the lake, the second largest summer storm did not produce elevated fecal coliform levels while the third and fourth largest storms did. The models predicted these events. The STORM model was calibrated on a subcatchment and supplied tha runoff flow volumes and pollution levels to the dynamic lake model. The other input data for the lake model were supplied by field measurements. The models were used to assess the effectiveness of management options to improve the water quality on the beach. Options studied include extension of the Britannia Pier, installing an offshore momentum diffuser, and removing the effects of one or two of the major upstream drainage basins. The cheapest option that ensures acceptable beach water quality is the pier extension, but this option requires an affective die-off of fecal coliforms. The next best solution is the offshore momentum diffuser, which also requires a 60 m extension to the Britannia pier. (Moore-IVI)
W85-01711

ENTERIC VIRUS LEVELS IN WASTEWATER EFFLUENTS AND SURFACE WATERS IN THE SEVERN TRENT WATER AUTHORITY 1979-1981,
Severn-Trent Water Authority, Birmingham (England).
R. Morris, and D. N. Sharp.
Water Research, Vol. 18, No. 11, p 935-939, 1984. 4 Fig, 1 Tab, 10 Ref.

Descriptors: *Enteroviruses, *Effluents, *Surface waters, *England, Coxsackie virus, Echovirus, Poliovirus, Water storage, Path of pollutants.

Large volumes of wastewater effluent are being discharged into rivers, many of which are being used for potable supply. Viral surveillance of 381 wastewater effluents and 533 surface waters was carried out between January 1979 and July 1981 within the Severn Trent Water Authority's area. Enteric viruses were detected in 45% of the samples of effluents and in 48% of the samples of surface waters. Viral levels in effluents varied considerably with highest recovered being 31,000 plaque forming units per liter (pfu/l). A substantial number of effluent samples gave levels lower than the practical detection limit of 100 pfu/l. Levels were markedly lower in surface waters, the highest being 647 pfu/l. River water which had received long-term bankside storage only yielded virus infrequently. A total of 1283 isolates from 914 samples of wastewater effluents and surface waters were successfully subcultured and identified. Only three echovirus serotypes were identified. The poloviruses showed a broadly recurring pattern probably associated with vaccination programs. Coxsackie group B viruses were common than polioviruses with only type 6 not being recorded. (Moore-IVI)
W85-01718

STUDY OF THE COPPER-COMPLEXING COMPOUNDS RELEASED BY SOME SPECIES OF CYANOBACTERIA,
Liverpool Univ. (England). Dept. of Botany.
W. F. Jardim, and H. W. Pearson.
Water Research, Vol. 18, No. 8, p 985-989, 1984. 5 Fig, 1 Tab, 27 Ref.

Descriptors: *Cyanophyta, *Copper, *Metal complexing, Plectonema, Anabaena, Conditional stability constants, Heavy metals.

The production of copper-complexing extracellular material by cyanobacteria was studied by using ion specific electrodes. The species studied were Plectonema boryanum and Anabaena cylindrica. The values of the conditional stability constants for the copper complexes (K'), for the two species at pH 6.60 (+/- 0.05) were, respectively 2.8 (+/- 0.8) x 10 to the 6th and 5.9 (+/- 2.0) x 10 to the 7th. A strain of P. boryanum that was made tolerant to a concentration of 1 x 10 to the -6th M copper produced greater amounts of copper-complexing products than the normal strain although the K' value for the copper complexes was the same. When stressed with copper, P. boryanum and A. cylindrica produced more complexing material than under the usual growth conditions. (Author's abstract)
W85-01725

FORMATION OF STABLE ORGANIC CHLORAMINES DURING THE AQUEOUS CHLORIN-

ATION OF CYTOSINE AND 5-METHYLCYTOSINE,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 5F.
W85-01726

KINETICS AND PRODUCTS OF THE CHLORINATION OF CAFFEINE IN AQUEOUS SOLUTION,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
J. P. Gould, and J. T. Richards.
Water Research, Vol. 18, No. 8, p 1001-1009, 1984. 13 Fig, 2 Tab, 14 Ref.

Descriptors: *Caffeine, *Chlorination, Wastewater, Natural waters, Hypochlorous acid, Chemical reactions, Chlorocaffeine, Kinetics.

Among the low molecular weight organic compounds which have been identified in wastewaters and natural waters is the purine base caffeine. This compound is present as a direct result of the consumption of coffee. The reaction between aqueous hypochlorous acid and caffeine was found to be dependent on pH only to the extent that it influences the fraction of FAC which is in the form of HOCl. The rate constant had a value of 162 +/- 32/M sq/s. For each mol of caffeine consumed, 6.3 mol of FAC were consumed. The chlorination reaction proceeded primarily by ring cleavage and rearrangement forming nonoaromatic nitrogen heterocyles. 8-Chlorocaffeine was unequivocally identified as an aqueous chlorination product but was found to be formed only to a small extent and under rather limited conditions. No stable organic chloramines were formed. (Moore-IVI)
W85-01727

REMOVAL OF VOLATILE ORGANIC POLLUTANTS FROM RAPID STREAMS,
New Mexico State Univ., Las Cruces. Dept. of Civil Engineering.
F. Cadena, G. A. Eiceman, and V. J. Vandiver.
Journal of the Water Pollution Control Federation, Vol. 56, No. 5, p 460-463, May, 1984. 4 Fig, 1 Tab, 20 Ref.

Descriptors: *Benzene, *Chlorobenzene, *Volatilization, *Organic compounds, *Rivers, Model studies, Volatile compounds, Model studies, Fate of pollutants.

An integrated theory of volatilization of volatile organic compounds (VOCs) in rivers is presented and a volatilization model for direct use with rivers is described. Advantages and features of this model are demonstrated with theoretical applications and large-scale modeling studies. Discussion is restricted to certain volatile compounds. Thirty-one of 165 priority pollutants have been defined by the US EPA that are volatile enough to be controlled only by liquid-phase diffusion. In this study the volatilization rates of benzene and chlorobenzene and the reaeration coefficient were measured using a 1000-L closed circuit circular stream. Saturated aqueous solutions of two VOCs chosen for modeling were prepared. The reaeration rate of the stream was contolled by changing the angular velocity of the rotating walls and by varying the water depth and bottom configuration. The range of reaeration coefficient covered in this study was from 0.14 to 1.96/hr. The VOC concentration range measured in the volatilization experiments was from about 1.0 mg/L to as low as 1.0 micro g/L. A hypothetical example was selected to illustrate the simplicity of the model for prediction of toxic VOC movement in streams - an accidental discharge of methylene chloride and 1,4-dichlorobenzene at the Interstate Highway 25 bridge over the Rio Grande, immediately below Albuquerque New Mexico, with river flow at minimum flowrate conditions. The chemical spill is assumed to be immediately mixed with the river water at 20 C. The model is used to predict the expected concentration fraction remaining for the pollutants as a function of time and distance. (Baker-IVI)
W85-01738

ANALYSIS OF AQUEOUS SEDIMENTS FOR HEAVY METALS,
Texas Southern Univ., Houston. Dept. of Chemistry.
V. O. Ogugbuaja, R. R. Schwarzer, and B. L. Wilson.
Journal of Environmental Science and Health, Vol. A(19), No. 8, p 911-924, December, 1984. 3 Fig, 2 Tab, 19 Ref. DOE grant ER-78-G-05-6079.

Descriptors: *Heavy metals, *Lake sediments, *Industrial wastes, *Powerplants, *Houston, *Texas, Cadmium, Copper, Zinc, Iron, Manganese, Sediments, Spectroscopy.

Atomic absorption spectroscopy was used to determine the concentrations of Cd, Cu, Zn, Fe, and Mn in sediments from lakes around a coal-powered electric generating plant in southwest Houston, Texas. The plant had been operational for only about one year at the time of sampling. As a result, the variations of trace metals with depth are considered to be essentially unaffected by the plant. The concentrations for each trace metal within a lake remained roughly the same. An attempt was made to correlate the trace metals with percent clay and organic carbon, but no trend was evident. (Baker-IVI)
W85-01742

HEAVY METALS IN THE LOWER MISSISSIPPI RIVER,
Centre National de la Recherche Scientifique, Paris (France).
E. J. Newchurch, and I. A. Kahwa.
Journal of Environmental Science and Health, Vol. A(19), No. 8, p 973-988, December, 1984. 11 Fig, 3 Tab, 14 Ref.

Descriptors: *Heavy metals, *Fate of pollutants, *Mississippi River, *Suspended sediments, Rivers, Arsenic, Lead, Mercury, Cadmium, Chromium, Copper, Filtration, Settling, Water treatment.

Samples of water from the Mississippi River were examined regularly to determine their content of heavy metals. Between 1978 and 1983, river water concentrations at individual sampling sites exceeded the drinking water standards 1 to 3% of the time for cadmium, chromium and copper; 7 to 9 % of the time for arsenic and lead; and 18% of the time for mercury. Arsenic, cadmium and chromium appear to be carried predominantly by the total dissolved solids and should be removed in the usual water treatment steps of coagulation followed by settling and/or filtration. Copper and lead appear to be carried, at least partly, in dissolved form, while additional data are needed for mercury. (Baker-IVI)
W85-01744

MINES: A MODEL TO FORECAST MINE WASTEWATER QUALITY,
Durham Univ. (England).
J. F. Bell, and M. J. Reeves.
International Journal of Environmental Studies, Vol. 20, p 47-52, 1982. 1 Fig, 20 Ref.

Descriptors: *Mine wastes, *Forecasting, *Wastewater, Mine drainage, Acid mine drainage, Computer models, Pyrite, Water pollution sources, Weathering, Model studies.

The minerals exposed by mining operations are abruptly subjected to a major change in their chemical and physical environment and undergo mechanical and chemical degradation (weathering). As a direct consequence, large quantities of water soluble compounds may be released and dissolved in percolating groundwater and surface waters. The breakdown of the mineral pyrite is a particularly important aspect of weathering in coal and metalliferous mines since acid ferruginous drainage waters can be produced. A probability model formulation procedure is suggested, including a description of the model MINES which was developed to forecast the likelihood and type of acid and ferruginous mine drainage occurring in a specific situation. MINES was validated on the basis of its abiliity to correctly forecast mine wastewater quality in well-documented case histories in the literature. (Moore-IVI)
W85-01750

TRACE METAL CONCENTRATIONS OF THE WATERS OF A SOUTH INDIAN RIVER,
Mysore Univ. (India). Dept. of Botany.
R. K. Somashekar, S. N. Ramaswamy, and G. D. Arekal.
International Journal of Environmental Studies, Vol. 20, p 63-65, 1982. 3 Tab, 25 Ref.

Descriptors: *Heavy metals, *Path of pollutants, *Kapila River, *India, Copper, Lead, Cadmium, Nickel, Cobalt, Chromium, Zinc, Water analysis.

Copper, zinc, lead, cobalt, chromium, cadmium and nickel were analyzed in both surface and bottom water samples at six sampling stations of the river Kapila, Karnataka, India. Concentrations of the various metals varied from station to station. The variation was due to difference in the degrees of pollution which are of domestic and industrial origin. Bottom samples had more dissolved metals than the surface water samples. Copper concentration was above the highest desirable limit at 3 stations which receive much domestic waste. Lead and cadmium concentrations were above the maximum permissible levels at all stations. Chromium concentration was very low at all stations except one and nickel concentration at 2 stations was high compared to the other stations. At the less polluted stations metal concentration is higher during summer, followed by rainy and winter seasons. At the more polluted stations maximum readings were recorded during winter, followed by summer and rainy seasons. This variation is attributed to variance in effluent load added to the river and the amount of discharge of water from the dam. (Baker-IVI)
W85-01751

ROLE OF SEDIMENTS IN THE NITROGEN BUDGET OF LOWER GREEN BAY, LAKE MICHIGAN,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
R. L. Chen, D. R. Keeney, and T. H. McIntosh.
Journal of Great Lakes Research, Vol. 9, No. 1, p 23-31, 1983. 2 Fig, 7 Tab, 27 Ref.

Descriptors: *Green Bay, *Lake Michigan, *Lake sediments, *Nitrogen, Water pollution sources, Cycling nutrients, Limiting nutrients, Eutrophication, Nonpoint pollution sources, Nitrification, Denitrification, Water pollution control.

The extreme southern portion of Green Bay is a shallow (1 to 5 m depth), eutrophic water body which receives considerable nutrients from the Fox River and metropolitan Green Bay, Wisconsin. Research to evaluate the effect of sediments on nitrogen (N) in the bay entailed periodic sampling of waters and sediments at six sites over 20 months and laboratory investigations of the rates of nitrification, denitrification, mineralization, immobilization, and N2 fixation. The monitoring data indicated that the N concentrations, approximately 0.6 and 0.8 mg/L of inorganic and organic N, respectively, in the bay waters are considerably higher than the threshold limits that may cause algal bloom and aquatic weed problems. Consideration of the available sediment N pool with respect to recognizable N inputs indicated that only 1.2% of the yearly N loading from the Fox River is present in the active sediment layer. Nitrification and subsequent denitrification at the sediment-water interface as a result of intermittent wind stirring could be a major sink for N, but presently it has a minor impact due to the high loading rate of N in this ecosytem. The study indicates that even if approximately 50% of the present point source loading of N were eliminated by pollution abatement, the N input from nonpoint sources (combined with existing concentrations of phosphorus in the bay waters) would be sufficient to maintain eutrophic conditions. (Author's abstract)
W85-01754

NET ATMOSPHERIC INPUTS OF PCBS TO THE ICE COVER ON LAKE HURON,
De Paul Univ., Chicago, IL.
T. J. Murphy, and A. W. Schinsky.
Journal of Great Lakes Research, Vol. 9, No. 1, p 92-96, 1983. 3 Fig., 1 Tab., 12 Ref. EPA grant R805325.

Descriptors: *Atmospheric deposition, *Polychlorinated biphenyls, *Ice cover, *Lake Huron, Water pollution sources, Precipitation, Conductivity, Ice cores, Snow, Great Lakes.

Protected areas of the Great Lakes usually are completely frozen over for 8-12 weeks each winter. During this time, the ice surface accumulates precipitation and dry deposition, and the materials they contain. When the ice melts in the spring, all these material go into the lnke. Measurements of the net atmospheric depositon of PCBs were made on ice cores collected from the frozen surface of Lake Huron late in the ice seasons of 1978 and 1979. Ice cores were separated into segments and melted. Based on subjective appearance and specific conductivity, the segments were divided into a depositional layer sample (cloudy, high specific conductivity) or a frozen lake water (clear, low specific conductivity) sample. Intrusions of lake water into the accumulated deposition layer of ice and snow were not encountered. For Saginaw Bay, a net deposition rate of 2.0 gm/sq km/mo of PCBs to the ice was found for the winters of 1977-1978 and 1978-1979. Upon ice break-up and thaw in the spring, all of the PCBs accumulated on the ice are likely to enter the bay. For inner Saginaw Bay, this would have been 8 kg in March 1978 and 6.5 kg in March 1979. The analysis of ice cores, a method which had been tried but not found to be useful for determining accumulated atmospheric deposition on small lakes, worked very well for frozen areas of the Great Lakes. (Moore-IVI)
W85-01759

HEAVY METALS IN ULVA LACTUCA COLLECTED WITHIN TOLO HARBOUR, AN ALMOST LANDLOCKED SEA,
Chinese Univ. of Hong Kong, Shatin. Dept. of Biology.
M. H. Wong, T. T. Kwok, and K. C. Ho.
Hydrobiological Bulletin, Vol. 16, No. 2-3, p 223-230, December, 1982. 2 Fig, 3 Tab, 32 Ref.

Descriptors: *Heavy metals, *Harbors, *Path of pollutants, *Tolo Harbor, *Hong Kong, Copper, Zinc, Lead, Iron, Aquatic plants, Bioindicators.

Tolo Harbor is an almost land locked sea with only a narrow outlet. The size and volume of the harbor have constantly decreased since the construction of the Plover Cover Reservoir in the late 1960s. The large scale reclamation due to the expansion and development of two satellite cities, Tai Po and Shatin as well as the construction of a race-course and circular roads in the late 1970s have further reduced the size and volume of the harbor, and affected the natural habitats of the shore-lines. The dilution effect of the tides and waves within Tolo Harbor has become minimal. There is a high content of heavy metals in the coastal water discharged from various industries including textile, wig and electroplating factories. Samples of seawater, sediment and U. lactuca were collected from different localities within, as well as far away from Tolo Harbor, in order to gain an understanding of the metal content of the alga and seafood collected within the harbor. Water and sediment analyses revealed higher concentrations of metals (copper, iron, lead, and zinc) within the harbor. Samples of algae from the most polluted area, Yuen Chau Tsai, had the highest contents of all tested metals with 134 micro g/g of copper. The extent of metal contamination was emphasized in the findings in the tissue of U. lactuca. Use of U. lactuca, one of the most common marine algae in Hong Kong, as a biological indicator would be valuable. (Baker-IVI)
W85-01762

STATISTICAL ANALYSIS AND EVALUATION OF WATER-QUALITY DATA FOR SELECTED STREAMS IN THE COAL AREA OF EAST-CENTRAL MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
J. H. Lambing.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4224, 1983. 89 p, 15 Fig, 8 Tab, 29 Ref.

Descriptors: *Water quality, *Statistical analysis, Regression, Flow duration, *Sediment load, Sediment yield, *Dissolved solids, *Montana, Fort Union coal region.

To document and evaluate existing conditions of water quality prior to proposed coal development in east-central Montana, water-quality data were collected at 23 sites on selected streams from October 1975 through September 1981. The data were statistically summarized and regression equations were developed to define relationships between water-quality variables. Where applicable, measured water-quality conditions were compared to various water-use standards. Measured concentrations of dissolved solids ranged from 145 to 12,200 milligrams per liter. Concentrations commonly exceeded 1,000 milligrams per liter and thereby present a high to very high salinity hazard for irrigation. Streamflow of the area contains predominantly sodium and sulfate ions and generally constitutes a medium to very high sodium hazard for irrigation during base flow. The water in most streams is generally adequate for livestock consumption during base flow. Concentrations of suspended sediment were extremely variable and had a direct correlation to water discharge. Measured suspended-sediment concentrations ranged from 4 to 23,000 milligrams per liter. Sediment-transport curves were developed for 18 of the study sites. Mean annual suspended-sediment loads were determined at five sites using the flow-duration, sediment-transport curve method. Mean annual sediment loads ranged from 1,010 to 72,7000 tons. (USGS)
W85-01770

ORIGINS AND DISTRIBUTION OF SALINE GROUND WATERS IN THE FLORIDAN AQUIFER IN COASTAL SOUTHWEST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2K.
W85-01778

HYDROLOGIC RESPONSES OF STREAM'S TO MINING OF THE MULBERRY COAL RESERVES IN EASTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-01782

GROUND-WATER QUALITY IN THE WESTERN SNAKE RIVER BASIN, SWAN FALLS TO GLENNS FERRY, IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01784

MUNICIPAL SOLID-WASTE DISPOSAL AND GROUND-WATER QUALITY IN A COASTAL ENVIRONMENT, WEST-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5E.
W85-01789

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE BLOOMFIELD COAL TRACT, DAWSON COUNTY, EASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01791

USE OF FIXED-BED ADSORBER MODELS TO PREDICT THE FLUXES OF TOXIC SUBSTANCES IN GROUNDWATERS AND SOIL ENVIRONMENTS,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
W. J. Weber, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202563, Price codes: A05 in paper copy, A01 in microfiche. Institute of Water Research Completion Report, Michigan State Univ., East Lansing, January 1984. 92 p, 44 Fig, 2 Tab, 40 Ref. Project No. OWRT A-12-MICH(1), Contract/Grant No. 14-34-0001-2124.

Descriptors: *Mathematical models, *Soil, *Toxic substances, *Groundwater, Kinetics, Organic carbon, Model studies, *Path of pollutants, *Sorption, Sands, Lindane, *Freundlich isotherms, *Solute transport, Mass transport.

Effective management of a ground water system requires description and prediction of the transport and fate of contaminants in that system. This can be facilitated by using mathematical models which accurately represent the physical phenomena operative in the system. One of the most significant phenomena impacting the transport of many organic pollutants is partitioning between the solid (soil) and aqueous (groundwater) phases. The tendency of a contaminant to partition may be roughly approximated from measurements of such constitutive properties as the octanol: water partition coefficient of the contaminant and organic carbon content of the soil. Such rough approximations provide a basis for cursory appraisal, but are inadequate for quantitative system descriptions, particulary where nonlinear equilibrium sorption, kinetically dependent partitioning, or irreversible and/or hysteretic phase distribution phenomena are operative. Accurate simulation of solute transport frequently requires the incorporation of kinetic parameters and/or a nonlinear isotherm relationship to define transport phenomena in the fundamental equations governing mass transport. Data collected for four sands and lindane indicates that equilibrium sorption is a nonlinear function best fit by the Freundlich isotherm. Results collected from completely mixed batch reactors of the bottle and stirred type indicate that sorption of lindane on the soils investigated is a kinetically controlled phenomena. These kinetic sorption data may be mathematically modeled in a number of ways with the Michigan Adsorption Design and Applications Model (MADAM) demonstrating good agreement with measured data.
W85-01793

EFFECTS OF PHOSPHATE FERTILIZER APPLICATIONS AND CHEMISTRY-MINERALOGY OF THE IRON OXIDE SYSTEM ON PHOSPHATE ADSORPTION-DESORPTION BY STREAM SEDIMENTS,
Ohio State Univ., Columbus. Dept. of Agronomy.
T. J. Logan, J. M. Bigham, K. S. Brady, and P. S. Nair.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202571, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Center, Columbus, Project Completion Report No. 712429, (1984). 102 p, 12 Fig, 19 Tab, 93 Ref. Project No. OWRT B-080-OHIO(1), Contract/Grant No. 14-34-0001-0242.

Descriptors: Eutrophication, *Acid mine water, Sulfates, Sediments, *Ohio, *Iron oxides, Pyrite, Anion adsorption, Prototype tests, *Mine drainage, *Phosphate adsorption, Phosphorus adsorption procedure, Muskingum River basin.

Suspended sediments from the Muskingum River and its tributaries were remarkably uniform in mineralogy and size distribution. Black Fork Creek, a tributary to Moxahala Creek which receives acid drainage from abandoned coal mines was chosen for detailed water quality and bottom sediment studies. Marked increases in dissolved SO4, Fe, and Al, and decreased pH were observed in sections of the stream affected by acid mine drainage. In addition, a gelatinous yellow iron precipitate was abundant in the bottom sediments below sources of pollution. This Fe-oxide or oxyhydrox-

ide precipitate greatly increased surface area and reactivity of bottom sediments and added to the overall sediment load. A standard P absorption procedure was proposed and the ability of four laboratories to produce consistent results over a wide range of soils was determined. Soil (0.5 or 1.0 g) was shaken in 0.01 mol/l CaCl2 at a soil:solution ratio of 1:25 in containers allowing a 50% head space for 24 hours at 24 to 26 degrees C on an end-over-end shaker. Initial dissolved inorganic P concentrations of 0 to 323 micronmol PL/l as (KH2PO4 or NaH2PO4) were used and microbial activity inhibited by 20 g/l chloroform. Excellent agreement between the four laboratories was obtained for P absorbed by the 12 soils studied, with a mean coefficient of variation over all P levels and soils of 0.91%. The laboratories also exhibited a high degree of replication of individual treatments with no laboratory showing a strong consistent bias across all soils and P levels in terms of P adsorption. The proposed method has the potential to produce consistent results which can be used to predict partitioning of dissolved inorganic P between solid and solution phases.
W85-01794

ACCUMULATION OF THE TRACE ELEMENTS LEAD AND ZINC BY ASELLUS COMMUNIS AT THREE DIFFERENT PH LEVELS,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Science.
T. Lewis, and A. McIntosh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202514, Price codes: A03 in paper copy, A01 in microfiche. Center for Coastal and Environmental Studies Completion Report, February 1984. 21 p, 19 Fig, 15 Tab, 17 Ref. Project No. OWRT A-068-NJ(1), Contract/Grant No. 14-34-0001-1132.

Descriptors: *Heavy metals, *Zinc, *Lead, *Sediments, *Bioaccumulation, *Hydrogen ion concentration, Isopods, Asellus communis, Trace elements.

The freshwater isopod Asellus communis was exposed to lead (Pb) and zinc (Zn) contaminated sediments at three different pH levels: 7.6, 5.5 and 4.5. Significant releases of trace elements occurred at pH 4.5 (Pb and Zn) and pH 5.5 (Zn only). Patterns of accumulation of the two trace elements by Asellus differed dramatically; there was little accumulation of Zn at any pH level, while significant increases in Pb concentrations were noted at the two lower pH levels. Both water and sediment appeared capable of acting as significant sources of Pb for the organisms.
W85-01795

FLUXES OF HEAVY METALS IN DELAWARE RIVER FRESHWATER TIDAL WETLANDS,
Rider Coll., Lawrenceville, NJ. Dept. of Biology.
R. L. Simpsom, R. E. Good, B. J. Dubinski, J. J. Pasquale, and K. R. Philipp.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-190057, Price codes: A05 in paper copy, A01 in microfiche. Center for Coastal and Environmental Studies Completion Report, Rutgers Univ., New Brunswick, NJ, December, 1983. 79 p, 22 Fig, 22 Tab, 54 Ref, 1 Append. Project No. OWRT A-060-NJ(1), Contract/Grant No. 14-34-0001-1132.

Descriptors: *Tidal marshes, *Marsh plants, *Litter, Aquatic soils, Cadmium, Copper, Lead, Nickel, Zinc, Activated sludge, Water pollution control, *Heavy metals, *Wetlands, *New Jersey, Woodbury Creek Marsh, Freshwater tidal wetlands, *Delaware River, Allocation patterns, Heavy metal retention.

A survey of ten wetlands showed soil heavy metals were generally lowest in rural areas and highest in urbanized and industrialized areas. Cr, Cu, and Cd levels were highest at transects nearest the Delaware River while Ni and Pb were highest near the tidal boundary indicating a differential importance of riverine and upstream inputs to these wetlands. Regression analysis showed significant ($P < or = .05$) positive relationships between % silt and Cr, Cd, Ni, and Pb. The high marsh through sites with the highest % silt likewise had the highest metal concentrations. Extensive studies at Woodbury Creek Marsh showed little seasonal pattern in soil metal concentrations, but distinct concentration gradients with depth and distance from a storm drain discharging nonpoint source runoff. The vegetation, while accumulating metals especially below ground, had much lower metal levels than the soil although the pattern of accumulation, Zn > Pb > Cu nearly = Ni > Cd, closely paralleled soil metal levels. Litter was enriched up to 20-fold as it decomposed with Cd and Ni levels reaching ambient soil levels while Cu and Pb were half to two-thirds those in the soil. Except for increases in Cr, the vegetation did not respond to the application of sewage sludge enriched with heavy metals. The soils of the high treatment sites (100 g/sq m/wk sludge) retained Cd (43%), Cr (53%), Cu (52%), Pb (31%), and Zn (51%) in the sludge at the end of the application period in October, but only Cd (15%) and Cr (12%) were still present the following March. The soils of the low treatment sites (25 g/sq m/wk sludge) retained only Cd (43%) and Cr (28%) in October, but these metals remained in the soil at the same level through the next March. Delaware River freshwater tidal wetlands have the capacity to sequester additional metals, but at a slow rate. Direct sedimentation and the litter are the major pathways for a long-term accumulation of heavy metals in these wetlands.
W85-01805

CHEMICAL STUDY OF THE INTERSTITIAL WATER DISSOLVED ORGANIC MATTER AND GASES IN LAKE ERIE, CLEVELAND HARBOR, AND HAMILTON HARBOUR BOTTOM SEDIMENTS--COMPOSITION AND FLUXES TO OVERLYING WATERS,
Wright State Univ., Dayton, OH. Brehm Lab.
D. D. Adams, G. G. Hess, N. J. Fendinger, D. A. Deis, and D. J. Wagel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-195783, Price codes: A09 in paper copy, A01 in microfiche. Ohio Water Resources Center, Ohio State Univ., Columbus, Report No. 712433, (1984). 187 p, 36 Fig, 32 Tab, 248 Ref, 1 Append. Project No. OWRT A-059-OHIO(1).

Descriptors: *Sediments, *Interstitial gases, Dissolved organic carbon, Methane, Nitrogen, Carbon dioxide, SOD chambers, *Lake Erie basins, Cleveland Harbor, Hamilton Harbour, *Dissolved organic compounds, Sediment porosity, Volatile solids, *Ohio, Water quality, Water pollution sources, Chemical analysis.

During 14 cruises in 1979 and 1980 SCUBA-collected sediment cores were obtained from the three basins of Lake Erie, Cleveland Harbor and Hamilton Harbour for determining interstitial water dissolved organic carbon (DOC) and dissolved gases (methane, nitrogen and total carbon dioxide). Sediments were also measured for volatile solids and water content, while EPA organic priority pollutants (purgeable, base/neutral and acid extractable) and molecular size ranges of dissolved organic matter (DOM) were evaluated in selected interstitial water samples. Because of high sediment concentrations, calculated diffusive losses of CH4 and sigma CO2 approximated 2-16% of the C influx to open lake sediments while 13-44% of the N sedimentation could be lost by denitrified N2 gas production. Diffusion of CH4 could account for up to 30% of the sediment oxygen demand. N2 gas was supersaturated in numerous interstitial water samples. Sediment interstitial water DOC ranged from an average of 6 mg/L in Lake Erie's central basin to 91 mg/L in Hamilton Harbour. DOM in open lake sediments consisted of high (> 20,000) molecular weight substances with few compounds indentified by GC/MS. A greater percentage of Hamilton Harbour DOM was less than 20,000 molecular weight with heterocyclic, aromatic and polynuclear (or unidentified and unresolved) type compounds suggestive of anthropogenic sources; some were identified as potentially hazardous. A significant linear relationship existed between DOC and CH4 in open lake and Cleveland Harbor sediments; this was not the case for Hamilton Harbour suggesting complex substances not decomposed by methanogens.
W85-01814

EFFECT OF VARIOUS HYDROLOGIC PARAMETERS ON THE QUALITY OF STORMWATER RUNOFF FROM A WEST LAFAYETTE, INDIANA URBAN WATERSHED,
Purdue Univ., Lafayette, IN. Dept. of Environmental Engineering.
M. S. Blumberg, and J. M. Bell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-207380, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Center Technical Report No. 162, January 1984. 121 p, 26 Fig, 19 Tab, 44 Ref, 2 Append. Project No. OWRT C-00090-U-IND(2), Contract/Grant No. 14-34-0001-0498.

Descriptors: *Wastewater effluents, Wastewater treatment, *Stormwater runoff, Water quality, Regression analysis, *Indiana, *Urban watershed, West Lafayette.

Increasingly stringent quality standards for wastewater effluents, and increased efficiency of wastewater treatment plant operations, have made the pollution due to stormwater runoff more obvious. This study investigated the quality of stormwater runoff from a 29 acre, fully developed, residential watershed. The importance of various hydrologic activities (average intensity of rainfall, peak intensity of rainfall, total rainfall, peak rate of runoff, total runoff, and duration of precipitation event) on stormwater pollutant concentrations, total mass (or number), and peak rates was evaluated by multiple regression analyses. One has 99% confidence in the regression models developed for total mass (or number) and peak rate of all pollutants studied, and 97% confidence in the models developed for average and peak concentrations of total coliforms. The hydrologic activities accounted for 33-87% of the variance in the pollutant data. Several postulated relationships were examined using data collected during this study. No relationship was apparent between the quantity of previous rainfall or the length of the antecedent dry period and the quality of stormwater runoff. Neither was an overall trend apparent between the time elapsed since street cleaning and the quality of stormwater runoff.
W85-01822

POTENTIAL FOR ACIDIFICATION OF SIX REMOTE PONDS IN THE WHITE MOUNTAINS OF NEW HAMPHIRE,
Northeastern Forest Experiment Station, Durham, NH.
D. C. Buso, C. W. Martin, and J. W. Hornbeck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-207349, Price codes: A08 in paper copy, A01 in microfiche. Water Resource Research Center Research Report No. 43, Univ. of New Hampshire, Durham, February, 1984. 157 p, 60 Fig, 71 Tab, 59 Ref, 2 Append. Project No. OWRT A-060-NH(1), Contract No. 14-34-0001-2131.

Descriptors: *Alkalinity, Sulfate, Aluminum, *Acid rain, *Acid precipitation, *Acidification, Ponds, White Mountains, *New Hampshire, Pond chemistry, Hydrogen ion concentration.

Six remote ponds and their watersheds in the White Mountains of New Hampshire were mapped, and chemical characteristics of the ponds and inlet streams were measured to estimate susceptibility to acid precipitation. The methods used and data collected during 1980-82 are included for possible comparisons with future studies or for alternative analyses and interpretations. Although the ponds are within a 20 km radius of each other and seemingly have similar watershed characteristics and precipitation chemistry, the volume-weighted pH between ponds ranged from 4.5 to 6.4. Volume-weighted alkalinity ranged from 0 to 144 micro-eq/l. Alkalinity was related to pH, basin morphology, production of hypolimnetic alkalinity, and chemistry of inlet streams. Historic pH and alkalinity data from these ponds are inadequate for determining if they are acidifying. Volume-weighted S04(2-) ranged from 70 to 170 micro-eq/l among the ponds. The ratios of divalent cations countering S04(2-) suggest that weathering within

the watersheds of the various ponds is an important factor in buffering acid precipitation and pond acidity. Volume-weighted total aluminum ranged from 0.10 to 0.60 mg/l. The most acidic ponds had the most total aluminum. The less acidic ponds appear to produce enough alkalinity and dissolved organic carbon to allow complexing of inorganic, toxic forms of aluminum. All ponds experienced short-term acidification in the upper water as a result of snowmelt events. Four models for predicting the susceptibility of the six study ponds to acidification worked poorly. Each of the six ponds is unique and a broad approach at grouping them based only on one or two parameters is inadequate. W85-01834

RIVER ELBE: PROCESSES AFFECTING THE BEHAVIOUR OF METALS AND ORGANOCHLORINES DURING ESTUARINE MIXING,
Nederlands Inst. voor Onderzoek der Zee, Texel.
J. C. Duinker, M. T. J. Hillebrand, R. F. Nolting, and S. Wellershaus.
Netherlands Journal of Sea Research, Vol. 15, No. 2, p 141-169, July, 1982. 20 Fig, 1 Tab, 26 Ref.

Descriptors: *Elbe Estuary, *Fate of pollutants, *Path of pollutants, *Metals, *Polychlorinated biphenyls, Estuarine environment, Sedimentation, Erosion, Resuspension, Suspended solids, Dissolved solids, Particulate matter.

The Elbe Estuary is a coastal plain estuary. It debouches into the North Sea (Wadden Sea) near Cuxhaven, with the mouth being bordered by tidal flats. Attempts were made to determine the relative importance of chemical or physico-chemical processes, and sedimentation and resuspension processes on the behavior of metals (Cd, Zn, Cu, Pb, Cr, Mn, Fe, Ca, Al, Si, Ti, Mg), organic C and N and organochlorine compounds in the estuarine region of the River Elbe in summer 1976. Sedimentation and resuspension seemed to be relatively less important than in some other estuaries. This may result from a much less pronounced mud shoal in the Elbe estuary. Alternating sedimentation and erosion resulted in systematic variations in the composition of suspended matter in terms of the relative contributions of two fractions: permanently suspended small and low-density particles having higher contents (w/w) of Cd, Zn, Pb, Mg and organic C and N; and resuspended larger and denser (mud) particles having higher contents of Mn, Fe, Al, Si and Ti. In addition to Al silicates, organic matter and Fe and Mn oxides may be important sites for trace elements in both fractions, but particularly so in the permanently suspended fraction. Cd, Zn, Cu, Mn and Fe may have been removed from solution into suspended particles during the initial phases of estuarine mixing. Estuarine mud, acting as sink for particulate pollutants, may accumulate originally dissolved componenets. A wide range of PCB components with high and low degrees of chlorination was present in solution as well as in suspension. Water was the most important carrier for components with a low degree of chlorination, and seston for components with a high degree of chlorination. Concentrations of individual PCB components ranged from picograms to nanograms per liter. (Moore-IVI)
W85-01836

RIVER WESER PROCESSES AFFECTING THE BEHAVIOUR OF METALS AND ORGANOCHLORINES DURING ESTUARINE MIXING,
Nederlands Inst. voor Onderzoek der Zee, Texel.
J. C. Duinker, M. T. J. Hillebrand, and R. F. Nolting.
Netherlands Journal of Sea Research, Vol. 15, No. 2, p 170-195, July, 1982. 16 Fig, 1 Tab, 16 Ref.

Descriptors: *Estuaries, *Metals, *Fate of pollutants, *River Weser, Mixing, Chlorinated hydrocarbons, Particulates, Resuspension, Dissolved solids, Organic compounds, Polychlorinated biphenyls.

Measurements of dissolved and particulate suspended metals and organochlorine compounds were made along with studies on hydrographic and sedimentation-resuspension processes in the fresh water and the estuarine mixing zone of the tidal river Weser during typical spring tide conditions. The position of the mixing zone was 20 km upstream of its normal position as a result of the extremely low river discharge in the dry summer of 1976. Concentrations of Cd, Zn, Cu Pb, Mn, and Fe in solution in the mixing zone increased by contributions from interstitially dissolved components during resuspension of bottom sediments. Variations in the contents of metals in seston is interpreted in terms of varying contributions of different fractions that had different sedimentation and resuspension characteristics as well as different chemical composition. A wide range of PCB components with high and low degree of chlorination was present in solution and in suspension. Suspended particles were the most important carriers for components with higher degrees of chlorination. Concentrations of individual PCB components in fresh water varied between a few picograms per litre and the nanogram per litre range. The only compounds present in the estuary and the Wadden Sea above the detection limit in 1 liter samples were alpha- and gamma-hexachlorocyclohexane in the low and sub ng/liter range. (Baker-IVI)
W85-01837

ONE-DIMENSIONAL MIXING AND FLUSHING MODEL OF THE EMS-DOLLARD ESTUARY: CALCULATION OF TIME SCALES AT DIFFERENT RIVER DISCHARGES,
Nederlands Inst. voor Onderzoek der Zee, Texel.
For primary bibliographic entry see Field 2L.
W85-01838

USE OF A MODEL TO ASSESS FACTORS AFFECTING THE OXYGEN BALANCE IN THE WATER OF THE DOLLARD,
Biologisch Centrum, Haren (Netherlands).
For primary bibliographic entry see Field 2L.
W85-01839

BEHAVIOUR OF POLYCYCLIC AROMATIC HYDROCARBONS IN THE EXE ESTUARY, DEVON,
Bayreuth Univ. (Germany, F.R.). Lehrstuhl fuer Hydrologie.
R. Herrmann, and D. Hubner.
Netherlands Journal of Sea Research, Vol. 15, No. 3/4, p 362-390, December, 1982. 18 Fig, 3 Tab, 50 Ref.

Descriptors: *Polycyclic aromatic hydrocarbons, *Estuaries, *Sediments, *Runoff, Fate of pollutants, Path of pollutants, Model studies, Hydrocarbons, Suspended sediments.

Polycyclic aromatic hydrocarbon (PAH) pollution resulting from river runoff to a receiving estuary is associated with suspended sediments. This is due to the high sorption coefficients on suspended and bottom sediments. Thus, the highest concentrations of PAH are found along the tidal channel within the mixing zone. The regional and temporal variation of suspended PAH, which was measured at 4 anchor stations during complete tidal cycles and at 4 traverses along the main tidal channel, is characterized by an increase of suspended PAH concentration and net positive fluxes from the river into the mixing zone and a subsequent decrease toward the sea. In the upper water column higher concentrations per weight of suspended sediment have been observed than in the lower one. This may be explained by a greater adsorption coefficient of the upper fine suspended sediments and a dilution by landward transport of marine suspended sediments near the bottom. A lab experiment involving short term (2 hrs) interaction of suspended PAH with increasing salinities did not show significant removal of PAH from suspension. In a long term (a few hours) interaction, the importance of sea water electrolytes for the removal of suspended PAH could be proved. The connection between regional distribution of suspended PAH and estuarine circulation was demonstrated by a two-dimensional box model. (Baker-IVI)
W85-01841

KEPONE CONCENTRATION IN JUVENILE ANADROMOUS FISHES,
Virginia Inst. of Marine Science, Gloucester Point.
J. G. Loesch, R. J. Huggett, and E. J. Foell.
Estuaries, Vol. 5, No. 3, p. 175-181, September, 1982. 1 Fig, 3 Tab, 25 Ref.

Descriptors: *Kepone, *Fish, *Potomac River, *Rappahannock River, *Pamunkey River, *Mattaponi River, *Chickahominy River, *James River, *Virginia, Alewife, Shad, Herring, Bass, Pesticides, Path of pollutants, Aeolian contamination.

The James River was closed to all forms of fishing in December 1975 as a result of Kepone contamination. The ban was later modified to allow fishing for American shad, alewife, blueback herring, and catfishes. Young-of-the year alewife, American shad, blueback herring, and striped bass were analyzed for Kepone contamination. Samples were collected from the Potomac, Rappahannock, Pamunkey, Mattaponi, Chickahominy, and James rivers during the period 1977-79. Concentrations of Kepone $>$ or $=$ 0.03 ppm occurred in all four species collected in the James River nursery zone between km 65 and 120, and in the lower Chickahominy River. Kepone was not detectable in samples from the Rappahannock and Potomac rivers. Concentrations of Kepone $<$ 0.3 ppm were also present in samples from the Mattaponi and Pamunkey rivers. Possible explanations for the occurrence of Kepone in these samples from the upper York River system (Mattaponi and Pamunkey rivers) include: sample contamination or misidentification; migration of juveniles from the James River; migration of adults to the York River system from the James River after contamination but prior to spawning; and aeolian contamination of the upper York river watershed due to its juxtaposition to the James River. Aeolian transport is believed to be most likely. (Moore-IVI)
W85-01847

TIDAL AND SEASONAL VARIATIONS OF SULFATE ION IN A NEW JERSEY MARSH SYSTEM,
Kean Coll. of New Jersey, Union. Dept. of Chemistry-Physics.
G. W. Luther, III, A. L. Meyerson, K. Rogers, and F. Hall.
Estuaries, Vol. 5, No. 3, p 189-196, September, 1982. 5 Fig, 1 Tab, 31 Ref. NOAA grants 04-6-158-44042 and 04-7-158-44-042.

Descriptors: *Piles Creek Marsh, *New Jersey, *Sulfates, *Tidal effects, *Seasonal variation, Estuarine environment, Chlorides, Water temperature, Dissolved oxygen, Hydrogen ion concentration, Rainfall, Productivity, Metals, Fate of pollutants.

In order to investigate possible sulfate reactions in a polluted system, Piles Creek Marsh off Newark Bay in New Jersey was chosen as a study site. The entire estuarine system is surrounded by highly industrialized areas and has become highly polluted. Sulfate variations during a tidal cycle were investigated at three sites. Sulfate-chlorinity relationships were determined in the light of fluctuations in temperature, dissolved oxygen and pH. The relationships were seasonal in nature, being affected by temperature and rainfall effects on biologic productivity. Both reduction of sulfate ion to a sulfide species and oxidation of sulfide species to the sulfate ion were found to occur. The sulfate ion concentration is not conservative in the tidal marsh system. As high tide waters flow through the sediment, sulfate reduction occurs. This reduction process will produce a sulfide species capable of precipitating many metal ions, especially in highly polluted environments. At low tide waters, sulfide minerals in creek sediments may be oxidized during high pH and dissolved oxygen events such as biological productivity. In Piles Creek Marsh, the large differences in the magnitude of the oxidation and reduction processes might cause a net export of sulfate ion from the marsh to the Arthur Kill. Such an export of sulfate ion might also cause a mobilization of metals which had precipitated as sulfides. (Moore-IVI)
W85-01848

ORIGIN OF NITRATES IN GROUNDWATER OF THE BUNZ VALLEY (WOHER STAMMEN

DIE NITRATE IM GRUNWASSER DES BUNZTALES),
Kanton Aargau, Aarau (Switzerland). Informations- und Dokumentations-dienst.
W. Fricker.
Wasser, Energie, Luft, Vol. 75, No. 3, p 75-77, 1983.

Descriptors: *Groundwater pollution, *Nitrates, *Bunz valley, *Switzerland, Water pollution sources, Animal wastes, Fertilizers, Sludge disposal, Water pollution control, Water treatment.

A study was ordered in 1975 to determine the origins of nitrates in the groundwater of the Bunz valley, Aargau Canton, Switzerland. This followed the discovery of increasing nitrate concentrations in groundwater wells in the region between 1970 and 1975, occasionally exceeding the Swiss maximum permissible level of 40 mg/l. The Bunz valley covers 8,600 ha, of which 53% is used agriculturally. The main source of nitrate was the agricultural application of nitrogen to the soil, which totals about 430 kg/yr. Half of this is applied as direct manuring (73.8% farmyard manure, 23.8% mineral fertilizer and 2.4% sludge from wastewater treatment plants). About 2.3% of this appears in runoff as nitrate. Increased nitrate concentrations can be expected when a large proportion of land is fallow, when fallow land is fertilized with nitrogen at times other than the growing season, and when fertilization is performed at the incorrect time. Short-term measures to combat this are to educate farmers in correct fertilization and planting practices, to institute fertilization restrictions in ground water conservation areas, and to reduce nitrates in drinking water by ion exchange or reverse osmosis. Intermediate measures are to dilute nitrate-rich wells with water from nearby wells with low nitrate levels and to cultivate only those crops (grass alone in extreme cases) that prevent excessive runoff of nitrates. (Gish-IVI)
W85-01856

HEAVY METAL MIGRATION IN SOIL-LEACHATE SYSTEMS,
Miami Univ., Coral Gables, FL. Dept. of Mechanical Engineering.
K. V. Wong, S. Sengupta, D. Dasgupta, E. L. Daly, Jr., and N. Nemerow.
BioCycle, Vol. 24, No. 1, p 30-33, January/February, 1983. 3 Fig, 8 Tab, 10 Ref.

Descriptors: *Heavy metals, *Soil properties, *Migration, *Permeability, Groundwater pollution, Mathematical model, Leachates.

Prediction of heavy metal migration in soil-leachate systems requires an understanding of the various mechanisms governing the behavior of the soil and the leachate. Four specific soils from Pomano Beach, Florida were studied: Hallandale fine sand, Plantation muck top layer, Plantation muck middle layer, and Plantation muck bottom layer. The first two are sandy in nature while the last two are clayey. Experiments were conducted to determine the manner in which the cations distributed themselves between the characteristic liquid and the four types of soil studied in the present work. The distribution coefficients of eight cations (Cu, Fe, Mn, Ni, Cd, Cr, Ca, Zn) between a complex mixture and the four soil types were determined. The Lapidus-Amundson model and the Langmuir model were used to predict the migration of the heavy metal ions in soil-leachate systems. The relative mobilities of the eight cations have been quantitatively measured in terms of the length of time taken by each cation to reach steady state under a fixed set of initial and boundary conditions. The relative mobility of a cation in the mixture as predicted by the Lapidus-Amundson model is different from that predicted by the Langmuir model. (Baker-IVI)
W85-01868

UPTAKE OF KEPONE FROM SEDIMENT SUSPENSIONS AND SUBSEQUENT LOSS BY THE OYSTER CRASSOSTREA VIRGINIA,
Virginia Inst. of Marine Science, Gloucester Point.
R. Morales-Alamo, and D. S. Haven.
Marine Biology, Vol. 74, No. 2, p 187-201, 1983. 11 Fig, 3 Tab, 59 Ref. EPA grant R804993010.

Descriptors: *Kepone, *Oysters, *Suspended sediments, *James River, *Virginia, Path of pollutants, Sediment contamination, Pesticides, Bioaccumulation, Concentration factor.

Oysters in laboratory trays received sediment suspensions prepared with sediments contaminated with Kepone from the James River, Virginia, USA. Oysters in trays were also exposed to water pumped directly out of two tributary creeks of the James River and in wire trays on the bottom of the James River. Oysters took up Kepone from the sediment suspensions very rapidly and the steady state in uptake appeared to be attained within one week. Loss of Kepone by oysters was also rapid. An average of 70% (95% confidence interval = 51-90%) of the Kepone in their tissues was eliminated during the first week, but a small residue was still present in the oysters after four weeks. The computed biological half-life of Kepone in oysters ranged between 3 and 10 d, with a mean of 5.2 d. Computation of concentration factors in the tissues of the experimental oysters included the volume of water in which the sediment particles were suspended. Concentration factors in laboratory experiments ranged from 574 to 4 167 and in field experiments from 28 000 to 56 000. Concentration factors were inversely related to concentrations in the sediment suspensions. It is suggested that this relationship may have resulted from interference of uptake by increasing concentrations of suspended matter or from a significant uptake of Kepone from solution. It is also suggested that Kepone available to oysters in solution may be of a magnitude similar to that available from sediments in suspension when the density of those sediments in the water is taken into consideration. (Author's abstract)
W85-01897

STATISTICAL ANALYSIS OF ESTUARINE PROFILES: II APPLICATION TO ARSENIC IN THE TAMAR ESTUARY (S.W. ENGLAND),
Marine Biological Association of the United Kingdom, Plymouth (England).
S. Knox, W. J. Langston, M. Whitfield, D. R. Turner, and M. I. Liddicoat.
Estuarine, Coastal and Shelf Science, Vol. 18, No. 6, p 623-638, June, 1984. 6 Fig, 5 Tab, 28 Ref.

Descriptors: *Tamar Estuary, *England, *Arsenic, *Estuaries, Statistical analysis, Sediments, Interstitial water, Manganese, Fate of pollutants, Iron oxyhydroxide, Oxidation.

By combining field observations with a statistical approach and a simple but effective estuarine analogue, the main features of the cycling of arsenic in the Tamar estuary have been elucidated. As(III) and As(V) enrichment in the water column is due to a combination of localized inputs and effective recycling of sediment interstitial waters. The profiles of As(V) are similar to those of NH4(+) and are dominated by an estuarine maximum resulting from an input from the sediments. As(III) profiles are correlated with those of dissolved manganese and exhibit both fresh water and estuarine maxima. As(III) appears to be effectively removed at the freshwater/brackish water interface by a combination of heterogenous oxidation, catalyzed by hydrous manganese dioxide, and adsorption on to iron oxyhydroxide. The estuarine distribution of As(III) within the water column is consistent with the published rates of oxidation of As(III) to As(V) by both inorganic and microbiological processes. The reduction of As(V) to As(III) in the sediments is incomplete. On the basis of the observations a tentative estuarine arsenic cycle is presented. (Author's abstract)
W85-01914

HYDROCARBONS IN WASHINGTON COASTAL SEDIMENTS,
Washington Univ., Seattle. School of Oceanography.
F. G. Prahl, and R. Carpenter.
Estuarine, Coastal and Shelf Science, Vol. 18, No. 6, p 703-720, June, 1984. 4 Fig, 4 Tab, 45 Ref. DOE contracts EY76-S-06-0225-TA40 and EY76-S-06-0225-T24.

Descriptors: *Hydrocarbons, *Sediments, *Washington, *Coastal waters, Aliphatic hydrocarbons, Polycyclic aromatic hydrocarbons, Fate of pollutants, Particulates.

The sources and distributions of polycylic aromatic hydrocarbons (PAH) and aliphatic hydrocarbons are characterized in seventeen sediments from a highly river-influenced sedimentary environment off the southwestern coast of Washington. The major hydrocarbons are land-derived, introduced as preformed compounds and display long-term stability in sediment cores. A series of PAH of anthropogenic origin and two naturally derived compounds, retene and perylene, dominate the PAH composition in these sediments. Plantwax n-alkanes are the major aliphatic hydrocarbon constituents. Aliphatic hydrocarbons of marine origin, pristane and a series of four acyclic, mutibranched C25 polyolefins, are also observed in many sediments. The concentrations of these marine-derived hydrocarbons decrease to negligible levels rapidly with sediment depth from the sea-sediment interface, suggesting degradation. In general, the major land-derived hydrocarbons are concentrated in the mid-shelf silt deposit which extends northwestward along the continental shelf from the Columbia River mouth. A quantitatively more minor, natural series of phenanthrene homologs, also of terrestrial origin, is preferentially advected further offshore and deposited in continental slope sediments. These distributions are consistent with recognized particle associations for these compounds and sediment dispersal processes in this coastal environment. Sediment core records suggest the present pattern of dispersal has persisted for at least the past century and possibly since the Late Pleistocene. (Author's abstract)
W85-01915

SHORT-TERM CHANGES IN THE BASE NEUTRALIZING CAPACITY OF AN ACID ADIRONDACK LAKE, NEW YORK,
Syracuse Univ., NY. Dept. of Civil Engineering.
C. T. Driscoll, and G. C. Schafran.
Nature, Vol. 310, No. 5795, p 308-310, July, 1984. 2 Fig, 2 Tab, 29 Ref.

Descriptors: *Acid lakes, *Base neutralizing capacity, *Acid rain, *Dart Lake, *New York, Aluminum, Nitrates, Carbonates, Sulfates, Hydrogen ion concentration, Snowmelt, Acidification, Atmospheric deposition.

The source of base neutralizing capacity (BNC) within acid surface waters has been attributed to atmospheric deposition of H2SO4 (or SO2) or HNO3, as well as production of soluble organic acids from soils. Aluminum is often a very significant component of BNC in acidic waters. Short-term changes in the BNC of Dart Lake, an acidic clearwater lake, were evaluated. Samples were collected for water quality analysis at the inlet, outlet and at seven depths, approximately evey two weeks over an annual cycle. Although H2CO3 was the major component of BNC in Dart Lake, levels of hydrogen ion and aluminum BNC in acid lakes are generally of more interest because of potential toxicity to organisms. Much of the variation in hydrogen ion and aluminum BNC can be attributed to changes in nitrate concentration, rather than to variations in sulfate, chloride, or organic anion concentrations. Sulfate is usually the dominant anion in Adirondack surface waters and in atmopheric inputs to the region. Additions of NO3(-) during snowmelt and depletions of NO3(-) associated with assimilation and reduction processes appear to be very inportant in regulating short-term changes in hydrogen ion and aluminum concentrations. (Moore-IVI)
W85-01917

EFFECTS OF CHANNEL EXCAVATION ON WATER-QUALITY CHARACTERISTICS OF THE BLACK RIVER AND ON GROUNDWATER LEVELS NEAR DUNN, NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 2A.
W85-01924

GROUND-WATER HYDROLOGY AND QUALITY BEFORE AND AFTER STRIP MINING OF A SMALL WATERSHED IN JEFFERSON COUNTY, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 4C.
W85-01943

HYDROGEOLOGY AND WATER QUALITY OF SIX LANDFILL SITES IN HILLSBOROUGH COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. W. Stewart, A. D. Duerr, and M. Fernandez, Jr.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4810, 1983. 112 p, 52 Fig, 19 Tab, 55 Ref.

Descriptors: *Solid-waste disposal, *Landfills, *Groundwater movement, *Groundwater pollution, *Karst hydrology, *Florida, Hillsborough County.

A hydrogeologic study of six landfills in Hillsborough County, Florida, showed that refuse was deposited in trenches constructed in the upper part of the surficial aquifer. Use of the trench method resulted in increased decomposition of refuse in water and accelerated degradation of water in the surficial aquifer because as much as 50 percent of the refuse was deposited in the saturated zone. Use of oxidation ponds to store water pumped from trenches that contained refuse, and refuse and debris that collected in perimeter ditches, affected the quality of water in the surficial aquifer. The trench method of landfilling has restricted use in Hillsborough County and other areas of Florida where high water levels occur. The potential for degradation of water in the surficial and Floridan aquifers may increase after a landfill is closed because maintenance generally is discontinued. Continued monitoring of surface- and ground-water sites would help to assess the long-term movement of leachate from a landfill and its effect on water quality. (USGS)
W85-01946

APPLICATION OF REMOTE-SENSING TECHNIQUES TO HYDROLOGIC STUDIES IN SELECTED COAL-MINED AREAS OF SOUTHEASTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
J. F. Kenny, and J. R. McCauley.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4007, 1983. 33 p, 10 Fig, 3 Tab, 19 Ref.

Descriptors: *Acid mine drainage, *Subsidence, *Erosion, Mine wastes, *Remote sensing, *Reclamation, *Revegetation, Aerial photography, *Water quality, Coal mines, Cherry Creek, *Kansas.

Disturbances resulting from intensive coal mining in the Cherry Creek basin of southeastern Kansas were investigated using color and color-infrared aerial photography in conjunction with water-quality data from simultaneously acquired samples. Imagery was used to identify the type and extent of vegetative cover on strip-mined lands and the extent and success of reclamation practices. Drainage patterns, point sources of acid mine drainage, and recharge areas for underground mines were located for onsite inspection. Comparison of these interpretations with water-quality data illustrated differences between the eastern and western parts of the Cherry Creek basin. Contamination in the eastern part is due largely to circulation of water from unreclaimed strip mines and collapse features through the network of underground mines and subsequent discharge of acidic drainage through seeps. Contamination in the western part is primarily caused by runoff and seepage from strip-mined lands in which surfaces have frequently been graded and limed but are generally devoid of mature stands of soil-anchoring vegetation. The successful use of aerial photography in the study of Cherry Creek basin indicates the potential of using remote-sensing techniques in studies of other coal-mined regions. (USGS)
W85-01947

INTEGRATED METHODOLOGY FOR INSTREAM FLOW STRATEGIES,
Duke Univ., Durham, NC. Dept. of Civil and Environmental Engineering.
M. A. Medina, Jr.
Water Resources Research Institute Completion Report, North Carolina State Univ., Raleigh, September, 1983. 142 p, 91 Fig, 19 Tab, 79 Ref.

Descriptors: Flow control, Stream fisheries, Streamflow, *Pollution load, Water quality, *Instream flow, Model studies, *Computer models, Simulation, *Computer programs, *North Carolina, Salem Creek, Path of pollutants, Water pollution sources, *Microcomputer programs.

An integrated methodology for instream flow strategies is presented, based on hierarchical package of computer models ranging from simple microcomputer programs to more complex mainframe simulation. The microcomputer programs are statistically based, and assume that both flows and pollutant concentrations are lognormally distributed for upstream sources, non-point sources and point sources. An extensive statistical analysis of nationwide data collected under the National Urban Runoff Program (NURP), as well as at the study site for the selected time series (Salem Creek, Winston-Salem, N.C.--November 1980 to August 1981), supports this assumption. The level of analysis progresses to an intermediate level: steady-state, continuous deterministic simulation. This level allows the representation of cause/effect (pollutant/water quality), coupled reactions.
W85-01951

FATE OF EPSILON-CAPROLACTAM IN THE AQUATIC ENVIRONMENT,
Syracuse Research Corp., NY.
L. Fortmann, and A. Rosenberg.
Chemosphere, Vol. 13, No. 1, p 53-65, 1984. 8 Fig, 2 Tab, 19 Ref.

Descriptors: *Fate of pollutants, *Degradation, *Caprolactam, Organic compounds, Temperature effects, *Nutrients, *Microorganisms, Industrial wastes, Solvents.

The rate and extent of caprolactam degradation in aquatic systems are dependent on the nutrient availability, indigenous microbial population and activity, chemical concentration, and water temperature. The labeled chemical evolved C-14 labeled CO2 indicating ring cleavage with between 35 and 80% of the radioactivity evolved as C-14 carbon dioxide after 21 days in yeast extract-supplemented waters. The percent of caprolactam degraded was indirectly related to the concentration in the water, suggesting microbial inhibition at high caprolactam concentrations. The addition of yeast extract or sediment to water significantly enhanced the rate and extent of caprolactam degradation. Most likely yeast extract acted by increasing the numbers of microorganisms capable of degrading the chemical. The influence of sediment may have been due to the possibility that in the sediment there is a much greater inoculum of caprolactam degrading microorganisms than in the lake or stream water. The sediment also provides a steady source of extra nutrients which are readily used up in the initial days of incubation. An increase in incubation temperature enhanced caprolactam biotransformation. Maximum degradation of caprolactam should be expected in warm, nutrient rich waters where microbial growth and metabolic activity can be maximized and caprolactam concentration is not toxic, thus enabling the microbial population to utilize the chemical as a carbon and/or nitrogen source. Primary degradation appears to be more easily mediated by microorganisms than mineralization, suggesting the buildup of potentially aromatically-intact metabolites of caprolactam. (Baker-IVI)
W85-01956

BIODEGRADABILITY TESTING OF POORLY WATER SOLUBLE COMPOUNDS,
Henkel K.G.a.A., Duesseldorf (Germany, F.R.). Dept. of Ecology.
P. Gerike.
Chemosphere, Vol. 13, No. 1, p 169-190, 1984. 5 Tab, 23 Ref. Umweltbundesamt grant 10602010.

Descriptors: *Organic compounds, *Biodegradation, Industrial wastes, Solubility, Chemical reactions, Fate of pollutants.

The biodegradability testing of poorly water soluble compounds is methodologically much less developed than it is for soluble substances. A few prerequisites for the biodegradability evaluation of poorly water soluble compounds such as the selection of suitable biological and analytical parameters, dispersion techniques, introduction of the test compound into the culture medium, and the choice of suitable inoculum were elucidated. Furthermore, various published and established tests were scrutinized for their suitability for the purpose under discussion. It is suggested that a modified Blok method holds presently the most promise as a screening test for the biodegradability testing of poorly water soluble organic compounds. Also examined were the UK-MITI Test, the closed bottle test, the Sturm test, and the Muller-Tittizer test. (Baker-IVI)
W85-01957

PREDICTION OF ECOTOXICOLOGICAL BEHAVIOUR OF CHEMICALS: RELATIONSHIP BETWEEN N-OCTANOL/WATER PARTITION COEFFICIENT AND BIOACCUMULATION OF ORGANIC CHEMICALS BY ALGA CHLORELLA,
Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Okologische Chemie.
H. Geyer, G. Politzki, and D. Freitag.
Chemosphere, Vol. 13, No. 2, p 269-284, 1984. 4 Fig, 1 Tab, 34 Ref.

Descriptors: *Fate of pollutants, *Organic compounds, *Bioaccumulation, *Algae, Chemical properties, Lipophilicity, Lipids.

The bioaccumulation potential of the green alga Chlorella fusca for organic chemicals was determined. Chemicals of different structures and physico-chemical properties were investigated to determine if there exists a relationship between the bioaccumulation factors of these compounds and their physicochemical properties. A quantitative relation was found between the lipophilicity (n-octanol/water partition coefficient) of the chemicals and the bioaccumulation factor. (Baker-IVI)
W85-01959

CONTRIBUTION OF LEACHING OF DIAZINON, PARATHION, TETRACHORVINPHOS AND TRIAZOPHOS FROM GLASSHOUSE SOILS TO THEIR CONCENTRATIONS IN WATER COURSES,
Institute for Pesticide Research, Wageningin (Netherlands).
M. Leistra, L. G. M. Th. Tuinstra, A. M. M. van der Burg, and S. J. H. Crum.
Chemosphere, Vol. 13, No. 3, p 403-413, 1984. 1 Fig, 3 Tab, 25 Ref.

Descriptors: *Pesticides, *Leaching, *Water pollution sources, Diazinon, Parathion, Tetrachlorvinphos, Triazophos, Organophosphates, Pesticide residues.

Data on the adsorption and transformation rates of diazinon, parathion, tetrachlorvinphos and triazophos in soils were collected from a survey of the literature. As little information is available on their mobility, the adsorption of tetrachlorvinphos and triazophos on three soils was measured in a slurry experiment. Properties of diazinon were introduced into a computer model simulating glasshouse soil systems in a simplified way. The leaching of diazinon from the root zone was calculated to be zero. The properties of the other three organophosphates indicate that in similar computations

leaching from the root zone would have been even lower. Samples from tile drains and water courses in areas with many glasshouses were analyzed by gas-liquid chromatography. The concentration of the four organophosphate insecticides in almost all the samples of water from the tile drains was below the detectable limit. However, in samples from the water courses, pesticide residues were found regularly, sometimes at fairly high concentrations. Thus contamination of water courses would seem to be produced not by leaching of pesticides through the soil but by other pathways. (Baker-IVI)
W85-01961

DISTRIBUTION OF NITRATES IN THE POTABLE WATERS OF SRI LANKA,
Sri Lanka Univ., Peradeniya. Dept. of Geology.
C. B. Dissanayake, S. V. R. Weerasooriya, and A. Senaratne.
Aqua, No. 1, p 43-50, 1984. 8 Fig, 2 Tab, 20 Ref.

Descriptors: *Nitrates, *Sri Lanka, *Potable water, Water analysis, Monitoring Water pollution sources, Fertilizers, Public health, Wastewater pollution.

An island wide survey of the nitrate levels in the potable waters of Sri Lanka has been carried out. In general the nitrate levels in the drinking water supplies are below the danger limits specified by the World Health Organization. However, there appears to be an increasing tendency for nitrates to accumulate in the groundwater in regions of high population density. The wet zone of Sri Lanka has higher nitrate levels possibly due to the shallow water table into which nitrates percolate easily from the surface. In the dry zone of Sri Lanka, even though the use of agricultural fertilizer is higher, due to the deeper water table observed nitrate levels are low. Infant mortality rates though not caused solely by the high nitrate levels, are also highest in the highlands of the wet zone. The Jaffna peninsula represents a very special case and this region contains the highest nitrate levels observed in Sri Lanka. The large usage of nitrogeneous fertilizer such as urea, discharge of human excreta into the shallow water table and the presence of highly fractured limestones as an aquifer are the chief reasons for the observed abundance. In other parts of Sri Lanka, densely populated areas contain higher nitrate contents and the island-wide distribution is influenced by climatic factors and fertilizer use as well. (Baker-IVI)
W85-02015

PESTICIDES IN GROUNDWATER BENEATH THE CENTRAL SAND PLAIN OF WISCONSIN,
Wisconsin Univ.-Madison. Water Resources Center.
J. M. Harkin, F. A. Jones, F. Fathulla, E. K. Dzantor, and E. J. O'Neil.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-212372. Price codes: A04 in paper copy, A01 in microfiche. Technical Report No. WIS WRC 84-01, 1984. 46 p, 9 Fig, 5 Tab, 24 Ref. Project No. OWRT A-094-WIS(1), Contract/Grant No. 14-34-0001-2153.

Descriptors: *Agricultural chemicals, Groundwater, Groundwater movement, *Groundwater pollution, *Pesticides, Soil properties, *Wisconsin, Central Sand Plain, Path of pollutants, Water pollution sources.

Groundwater samples were collected periodically from monitoring wells and multilevel samplers installed in nine 160-acre fields in the Central Sand Plain of Wisconsin. Potatoes were grown under irrigation in sandy soils over high water tables in each of these fields. All samples were tested for content of residues of aldicarb, a water-soluble systemic insecticide incorporated into soil once a year either with potatoes at planting at a rate of 3 lb/A or at shoot emergence at a rate of 2 lb/A. Regardless of application rate, timing or frequency (single or repeated applications in consecutive or alternate years) residues were found at some but not all locations tested within every field. Zones of contamination occurred only close to the water table and principally at locations where the soil and groundwater pH and alkalinity were low. As contaminated water sank with time to lower depths in the aquifer (10 to 12 feet below the water table), the concentrations of aldicarb residues fell dramatically or disappeared altogether, apparently as a result of alkali-catalyzed hydrolysis and bacterial metabolism superimposed upon physical dilution and dispersion. Samples of groundwater and aquifer sediments collected aseptically contained surprisingly high numbers of a large diversity of facultative anaerobic bacteria. These organisms can totally degrade aldicarb sulfoxide and aldicarb sulfone, the major metabolites of aldicarb which occur in groundwater, at a rate which suggests a half-life of about 1.3 years for aldicarb residues in Wisconsin groundwater.
W85-02025

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE CORRAL CREEK AREA, HANGING WOMAN CREEK COAL FIELD, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
N. E. McClymonds.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4260, 1984. 53 p, 9 Fig, 7 Tab, 22 Ref.

Descriptors: Hydrology, *Coal mines, Reclamation, *Montana, *Powder River Basin, Corral Creek, Hanging Woman Creek.

The Corral Creek area of the Hanging Woman Creek coal field, 9 miles east of the Decker coal mines near the Tongue River, contains large reserves of Federal coal that have been identified for potential lease sale. A hydrologic study was conducted in the area to describe existing hydrologic systems and to study assess potential impacts of surface coal mining on local water resources. Hydrogeologic data collected indicate that aquifers are coal and sandstone beds within the Tongue River Member of the Fort Union Formation (Paleocene age) and sand and gravel in valley alluvium (Pleistocene and Holocene age). Surface-water resources are limited to a few spring-fed stock ponds in the higher parts of the area and the intermittent flow of Corral Creek near the mouth. Most of the stock ponds in the area become dry by midsummer. Mining of the Anderson coal bed would remove three stock wells and would lower the potentiometric surface within the coal and sandstone aquifers. The alluvial aquifer beneath Corral Creek and South Fork would be removed. Although mining would alter the existing hydrologic systems and remove several shallow wells, alternative ground-water supplies are available that could be developed to replace those lost by mining. (USGS)
W85-02040

HYDROLOGY OF AN ABANDONED COAL-MINING AREA NEAR MCCURTAIN, HASKELL COUNTY, OKLAHOMA,
Geological Survey, Oklahoma City, OK. Water Resources Div.
L. J. Slack.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4202, 1983. 117 p, 12 Fig, 25 Tab, 43 Ref.

Descriptors: *Strip mines, Strip mine wastes, Mine drainage, Coal mines, Water quality, Land reclamation, *Oklahoma, Mule Creek, Hartshorne, McCurtain, Haskell County.

Bedrock in the area is shale, siltstone, sandstone, and coals of the McAlester and Hartshone Formations of Pennsylvanian age. The main avenues of water entry and movement are the exposed bedding plane openings, partings between laminae of shale, fractures and joints, and openings caused by surface mining. Water table conditions exist in bedrock and spoil in the area. Mine pond water is in direct hydraulic connection with water in the spoil piles and the underlying Hartshone Formation. For both surface water and ground water, in the McCurtain area, Sulfate is the best indicator of coal mine drainage. Median sulfate concentrations for four sites on Mule Creek range from 26 to 260 milligrams per liter. Median sulfate concentrations increase with increased drainage from unreclaimed (abandoned) mined areas. Reclamation likely would result in decreased concentrations of dissolved solids, calcium, magnesium, sodium, sulfate, and alkalinity for Mule Creek in the vicinity of the reclaimed area. Water in the mine ponds is quite similar to the shallow ground water. Water from ponds and ground water are unlikely in the long run to be changed by reclamation in the area. (USGS)
W85-02041

CALIBRATION AND VERIFICATION OF A RAINFALL-RUNOFF MODEL AND A RUNOFF-QUALITY MODEL FOR SEVERAL URBAN BASINS IN THE DENVER METROPOLITAN AREA, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2A.
W85-02044

SEDIMENTATION IN FLUVIAL AND LACUSTRINE ENVIRONMENTS,
Ottawa Univ. (Ontario). Dept. of Geology.
For primary bibliographic entry see Field 2J.
W85-02057

GEOCHEMISTRY OF THE RHINE AND THE RHONE AND HUMAN IMPACT (LA GEOCHIMIE DU RHIN ET DU RHONE ET L'IMPACT HUMAIN),
Centre d'Ecologie de Camargue (France).
For primary bibliographic entry see Field 2H.
W85-02059

WHOLE-LAKE LEAD BURDENS IN SEDIMENTS OF LAKES IN SOUTHERN ONTARIO, CANADA,
Ontario Ministry of the Environment, Rexdale.
P. J. Dillion, and R. D. Evans.
Hydrobiologia, Vol. 91, p 121-130, July, 1982. 4 Fig, 3 Tab, 18 Ref.

Descriptors: *Lead, *Ontario, *Lake sediments, Path of pollutants, Lakes, Sediments, Heavy metals, Atmospheric deposition, Deposition, Water pollution sources.

The anthropogenic stable lead content of the sediments of eight softwater Precambrian lakes in southern Ontario was measured at 34-92 sites per lake. Whole-lake anthropogenic lead burdens varied between only 610 and 770 mg/sq m. There was no relationship between lead burden and either water replenishment time of the lake (Tw) or the ratio of watershed area to lake area (A sub d/A sub 0), which varied by factors of 4 and 12 respectively. These results can be explained if; a) the lead deposition in this region is uniform, and b) the only significant input of lead to the lakes is via deposition from the atmosphere directly on the lakes' surfaces. Therefore spatial differences in anthropogenic lead within a lake represent the redistribution of focusing pattern of the sediments. (Author's abstract)
W85-02062

HISTORICAL CHANGES IN ANTHROPOGENIC LEAD FALLOUT IN SOUTHERN ONTARIO, CANADA,
Trent Univ., Peterborough (Ontario).
R. D. Evans, and P. J. Dillion.
Hydrobiologia, Vol. 91, p 131-137, July, 1982. 5 Fig, 19 Ref.

Descriptors: *Ontario, *Lead, *Found Lake, *Red Chalk Lake, *Bob Lake, Lake sediments, Water pollution sources, Path of pollutants, Sediments, Meromictic lakes, Dimictic lakes.

By combining the relative change in lead fallout through time, as observed in a meromictic lake,

with the total atmospheric deposition of lead, a historical record of lead deposition for remote areas can be developed. Sediment cores were collected in 1978 from meromictic Found Lake and from dimictic Red Chalk and Bob Lakes, in the Muskoka-Haliburton area of Ontario. For each of these sediment cores, a historical record of lead deposition at the sampling station was calculated. Lead deposition rose late in the nineteenth century and reached a maximum in the most recent sediments. Total lead deposition was assumed to be the average of that measured for eight other lakes in the study area; approximately 680 mg of anthropogenic lead per sq m have been deposited there. The validity of this historical record was tested on sediment cores from the two nearby dimictic lakes. A simplistic mixing model was used to predict lead profiles in the dimictic lakes. Predicted lead concentration profile closely resembled observed profiles. The historical record suggests that the primary source of anthropogenic lead in Haliburton is from non-local sources. (Collier-IVI)
W85-02063

ZINC IN WATER AND SEDIMENTS OF TWO FINNISH LAKES,
Tampere Univ. of Technology (Finland).
L. Koivo, and R. Oravainen.
Hydrobiologia, Vol. 91, p 155-160, July, 1982. 1 Fig, 5 Tab, 14 Ref.

Descriptors: *Lake Vanajavesi, *Lake Mallasvesi, *Finland, *Zinc, *Path of pollutants, Water pollution effects, Lake sediments, Industrial wastewater, Textile industry, Industrial plants, Water pollution sources, Heavy metals, Metals.

The occurence, distribution, and sedimentation of zinc was studied in water and sediment samples from Lake Vanajavesi and Lake Mallasvesi, in the Kokemaenjoki watercourse, South Finland. Lake Vanajavesi is one of the most polluted of large inland lakes in Finland. The zinc load comes mainly from industrial sources. Lake Mallasvesi, situated near Vanajavesi, is in an almost natural condition. The zinc concentrations in water (micrograms/L) vary between < 10 and 4,000 in Vanajavesi and < 10 in Mallasvesi. Sediment concentrations of zinc (g/kg DW) ranged from 0.2 to 13.2 in Vanajavesi and from 0.2 to 0.5 in Mallasvesi. A close correlation between sedimentation of zinc and waste discharge from a textile factory was found. During several winters, zinc has spread with waste water to different parts of Vanajavesi against the main course of flow. The flow is due to the movement of contaminated bottom water along a series of depressions in the lake bed. The entrainment is probably caused by great differences in density. The maximum zinc concentrations observed in Lake Vanajavesi are high enough to cause both acute and sublethal effects on lacustrine organisms. (Collier-IVI)
W85-02065

MODEL FOR INSTREAM REGULATION OF RADIOISOTOPES AND HEAVY METALS IN RIVERINE WATERS SUBJECTED TO A URANIUM MILL DISCHARGE,
Beak Consultants Ltd., Mississauga (Ontario).
M. Holloran.
Hydrobiologia, Vol. 91, p 175-188, July, 1982. 9 Fig, 4 Tab, 10 Ref.

Descriptors: *Saskatchewan, *Uranium mills, *Industrial wastewater, *Radioisotopes, *Radioactive wastes, Heavy metals, Thorium, Mathematical models, Nickel, Lead, Radium, Interstital water, Fluvial sediments, Path of pollutants, Mine wastes.

In the Athabaska sandstone region of northern Saskatchewan, mining and milling of uranium-bearing ore is subjecting, and will continue to subject, surface waters to inputs of soluble heavy metal and uranium and thorium decay series radioisotopes. A mathematical simulation model was developed to assess the role of riverine sediments in regulating soluble concentrations of heavy metals and radioisotopes released to the environment through treated mining and milling process effluents. Specific elements studied included As, Ni, Pb, U, and Ra-226. The model considered that diffusion into sediment porewater and adsorption by sediment particulates from sediment porewater were the two dominant mechanisms regulating sediment loading. Experiments indicated that the equilibrium adsorption behavior of the heavy metals and radioisotopes studied could be adequately explained using a linear adsorption isotherm, over the range of concentrations expected in the environment. Experimentally determined linear isotherm slopes ranged from 200 ml/g to 21,000 ml/g. Diffusion into the effective depth of the sediments (20 cm) was modelled using a quadratic (second order) driving force and a corresponding mass transfer coefficient. The model coefficients were calibrated using field and laboratory data. Results of the modelling suggested that the sediments have a small effect on instream concentrations during the active phases of mining and milling. The sediments were predicted to accumulate sufficient adsorbed mass, during the operational phase of mining and milling, to act as a distributed instream source after completion of milling activities. The significance of this post-operational source was a function of the initial effluent loading, elapsed time and site specific river characteristics. (Author's abstract)
W85-02068

EXPERIMENTAL MEASUREMENT OF SEDIMENT NITRIFICATION AND DENITRIFICATION IN HAMILTON HARBOUR, CANADA,
McMaster Univ., Hamilton (Ontario).
For primary bibliographic entry see Field 2H.
W85-02070

PARTITIONING OF PHOSPHORUS BETWEEN PARTICLES AND WATER IN A RIVER OUTFLOW,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Ecology and Systematics Section.
For primary bibliographic entry see Field 2H.
W85-02075

ACCUMULATIVE PHASES FOR HEAVY METALS IN LIMNIC SEDIMENTS,
Technische Univ., Hamburg-Harburg (Germany, F.R.). Arbeitsbereich Umweltschutztechnik.
U. Forstner.
Hydrobiologia, Vol. 91, p 269-284, July, 1982. 5 Fig, 5 Tab, 87 Ref.

Descriptors: *Heavy metals, *Lake sediments, *Clays, Acid rain, Zinc, Cobalt, Nickel, Lead, Copper, Cadmium, Iron oxides, Magnesium oxides, Carbonates, Sulfides, Fate of pollutants, Lakes.

Data from mechanical concentrates of recent sediments indicate that clay minerals, clay-rich aggregates and heavy minerals are the major carriers of heavy metals in detrital sediment fractions. Hydrous Fe/Mn oxides and carbonates and sulfides, in their specific environments, are the predominant accumulative phases for heavy metals in autochthonous fractions. Sequential chemical extraction techniques permit the estimation of characteristic heavy metal bonding forms: exchangeable metal cations, easily reducible, moderately reducible, organic and residual metal fractions, whereby both diagenetic processes and the potential availability of toxic compounds can be studied. The data from lakes affected by acid precipitation indicate that zinc, cobalt and nickel are mainly released from the easily reducible sediment fractions and cadmium from organic phases. In contrast at pH 4.4, neither lead nor copper seem to be remobilized to any significant extent. Immobilization by carbonate precipitation seems to provide an effective mechanism for the reduction of dissolved inputs of metals such as zinc and cadmium in pH-buffered, hard water systems. (Author's abstract)
W85-02077

HYDROCARBON ACCUMULATION IN FRESHWATER SEDIMENTS OF AN URBAN CATCHMENT,
Middlesex Polytechnic, London (England). Urban Stormwater Pollution Research Group.
A. Gavens, D. M. Revitt, and J. B. Ellis.
Hydrobiologia, Vol. 91, p 285-292, July, 1982. 6 Fig, 2 Tab, 16 Ref.

Descriptors: *London, *England, *Hydrocarbons, *Sediments, Aliphatic hydrocarbons, Phytane, Pristane, Urban watersheds, Path of pollutants.

The top and bottom of two sediment cores collected from an urban receiving basin in NW London, and stormwater samples from the attendant catchment, have been analyzed for their hydrocarbon content. In surface sediments, basal sediments and stormwater, total aliphatic hydrocarbon levels are 445-690 micro g/g dry wt., 43-224 micro g/g and 0.36-1.10 mg/L, respectively; and total levels of polyaromatic hydrocarbons (PAHs) are 780-1,100 micro g/g, 310-640 micro g/g and 5.83-18.21 mg/L, respectively. Biodegradation of aliphatics is assessed by phytane:n-C18 and pristane:n-C17 ratios. Hydrocarbon sources are determined from phytane:pristane ratios, odd:even carbon chain length ratios, the presence of an unresolved complex mixture, and by comparison of the amount of methyl-substituted PAHs with that of the parent compounds. Comparison of total levels between surface and basal sediments shows a 1 to 3 fold increase in total PAHs and a 3 to 10 fold increase in aliphatic hydrocarbons over a 120 year period. (Author's abstract)
W85-02078

DYNAMICS AND MECHANISMS OF ARSENITE OXIDATION BY FRESHWATER LAKE SEDIMENTS,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
P. M. Huang, D. W. Oscarson, W. K. Liaw, and U. T. Hammer.
Hydrobiologia, Vol. 91, p 315-322, July, 1982. 2 Fig, 5 Tab, 30 Ref. Natural Sciences and Engineering Research Council of Canada grants A3248, G0042, and G0515.

Descriptors: *Arsenic, *Lake sediments, *Oxidation, Adsorption, Arsenite, Lakes, Arsenate, Magnesium, Carbonates, Silicates, Saskatchewan, Sediments, Fate of pollutants.

There has been increasing concern over As in freshwater environments from sources such as arsenical pesticides, smelters, coal-fired power plants, and erosion caused by intensive land use. Arsenic in the reduced state, As (III) (arsenite) is much more toxic, more soluble and mobile, than when in the oxidized state, As (V) (arsenate). This paper summarizes the dynamics and mechanisms involved in the oxidation of As (III) to As (V) by freshwater lake sediments. Sediments from selected freshwater lakes in southern Saskatchewan oxidize As (III) to As (V) predominantly through an abiotic process. Solution analysis of As (III) and As (V) by colorimetry, and examination of the oxidation state of surface-sorbed As species by X-ray photoelectron spectroscopy, indicate that Mn present in the sediment is the primary electron acceptor in the oxidation of As (III). The transformation of As (III) to As (V) by carbonate and silicate minerals, common in sediments, is not evident. The heat of activation, delta H sub a, for the depletion (oxidation plus sorption) of As (III) by the sediments, varies from 3.3 to 8.5 kcal/mole, indicating that the process is predominantly diffusion-controlled. The Mn present in a series of particle size fractions (<2 - >20 um) of the sediments may potentially detoxify As (III) in aquatic systems, by converting it to As (V). (Author's abstract)
W85-02080

DISTRIBUTION AND CONCENTRATIONS OF NATURALLY-OCCURRING RADIONUCLIDES IN SEDIMENTS IN A URANIUM MINING AREA OF NORTHERN SASKATCHEWAN, CANADA,
Monenco Consultants Ltd., Calgary (Alberta).
P. A. Neame, J. R. Dean, and B. G. Zytaruk.
Hydrobiologia, Vol. 91, p 355-361, July, 1982. 3 Fig, 4 Tab, 18 Tab.

Descriptors: *Saskatchewan, *Radionuclides, *Sediments, *Uranium mining, Thorium, Radium, Polonium, Lead, Adsorption, Industrial wastes, Mine wastes, Path of pollutants.

Uranium mining and milling operations can contribute to environmental degradation through the increased release of naturally-occurring radionuclides. However, studies of the interactions of these radionuclides with freshwater sediments have been limited. The present study examined the vertical distribution of uranium, thorium, radium-226, polonium-210 and lead-210 in undisturbed sediment cores collected in the vicinity of mining, milling and exploration activities. Uranium levels in surface sediments ranged from 1.9 to 5650 micro g/g, Ra-226 from < 0.1 to 480 pCi/g and Pb-210 from 0.8 to 931 pCi/g in the samples reported here, with the highest values occurring downstream of waste rock disposal areas. Concentrations usually decreased with depth, and there was little evidence of any strong effect of bioturbation on radionuclide profiles at the scale examined here. Mathematical models of uranium and radium-226 adsorption on and movement into the sediment were constructed, based on expected adsorption coefficients and estimated loading. The model predictions of radionuclide distribution with depth were qualitatively similar to those actually measured, but the predicted concentrations were generally lower than those observed, both in unaffected areas and in areas adjacent to uranium extraction activities. (Author's abstract)
W85-02083

INFLUENCE OF WITHIN-STREAM DISTURBANCE ON DISSOLVED NUTRIENT LEVELS DURING SPATES,
Freshwater Biological Association, Wareham (England). River Lab.
For primary bibliographic entry see Field 2E.
W85-02089

DISSOLVED AND SUSPENDED MERCURY SPECIES IN THE WABIGOON RIVER (ONTARIO, CANADA): SEASONAL AND REGIONAL VARIATIONS,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
T. A. Jackson, J. W. Parks, P. D. Jones, R. N. Woychuk, and J. A. Sutton.
Hydrobiologia, Vol. 92, p 473-487, July, 1982. 13 Fig, 2 Tab, 29 Ref.

Descriptors: *Speciation, *Mercury, *Fate of pollutants, *Wabigoon River, *Ontario, Seasonal variation, Regional variation, Heavy metals, Organic compounds, Particulates, Sediment erosion.

Seasonal and regional variations in the speciation, sediment-water partitioning, and dynamics of mercury were studied at selected sites along the Hg-polluted Wabigoon River, and at unpolluted headwater and tributary sites, during April-September, 1979. CH3Hg(+) and inorganic Hg in Wabigoon River Water are predominantly particulate during the spring flood. In summer, particulate forms decline sharply while dissolved forms increase. In spring, transfer of Hg species from bottom sediments to water is due chiefly to physical erosion and resuspension of sediments by current action. Particulate Hg species are not readily solubilized, and are probably not readily available to organisms. Thus, the particulate Hg species mobilized in the spring are probably less bioavailable than the dissolved forms mobilized in the summer. Hg bound to wood-chip deposits blanketing the riverbed near the source of pollution appears to be less readily desorbed and methylated, and therefore less bioavailable than Hg bound to the silt clay mud. In the mid-summer, the dissolved Ch3Hg(+) level was a function of total dissolved Hg concentration. Hg species in particulates are associated with sulfide, iron and manganese oxides, organic and selenium. Any program for pollution control short of total removal of Hg from bottom sediments, would have to include immobilization, removal, or detoxification of the dissolved as well as the suspended forms of Ch3Hg(+) and inorganic Hg in the Wabigoon River water upstream from the lakes through which the contaminated water flows. (Baker-IVI)
W85-02091

MECHANISMS FOR RELEASE OF SEDIMENT-BOUND PHOSPHATE TO WATER AND

THE EFFECTS OF AGRICULTURAL LAND MANAGEMENT ON FLUVIAL TRANSPORT OF PARTICULATE AND DISSOLVED PHOSPHATE,
Ohio State Univ., Columbus. Dept. of Agronomy.
T. J. Logan.
Hydrobiologia, Vol. 92, p 519-530, July, 1982. 6 Fig, 50 Ref.

Descriptors: *Phosphates, *Lake sediments, *Particulates, Dissolved solids, Fate of pollutants, Water pollution sources, Water pollution control, Adsorption, Desorption.

The bulk of the phosphate load to lakes is from land drainage, and includes varying proportions of sediment-bound P and dissolved P. P sources which may enter a lake through land drainage include native soil phosphate, fertilizer P, and livestock and municipal wastes. Sediment-bound phosphate includes organic and inorganic forms, but the inorganic fraction contains most of the P that can be released into water. The non-apatite inorganic P (NAIP) fraction of sediment-bound phosphate varies considerably with geochemistry and anthropogenic additions. A small fraction of the NAIP is sufficiently labile to desorb into water, and this release can be described by dissolution or adsorption/desorption mechanisms. Agricultural practices, such as phosphate fertility management and conservation tillage, which affect the levels of phosphate and sediment leaving the land, will determine the partition of sediment-bound P and dissolved P in water draining into lakes. The response of algae to dissolved P must be different than to particulate P sources, which may settle out of the photic zone before thay can be completely utilized. Phosphorus control strategies for deep lakes, with little sediment resuspension or lake overturn, must emphasize dissolved P sources more than for shallower lakes, where sediments are continuously resuspended and lake overturn can bring P released from bottom sediments to the surface. (Moore-IVI)
W85-02095

SUMMER PEAK OF NUTRIENT CONCENTRATIONS IN LAKE WATER,
Japan Bottom Sediment Management Association, Tokyo.
T. Yoshida.
Hydrobiologia, Vol. 92, p 571-578, July, 1982. 15 Fig, 2 Tab, 1 Ref.

Descriptors: *Nutrients, *Lake sediments, *Lake Suwa, *Lake Koyamaike, *Japan, Seasonal variation, Water pollution sources, Water pollution control, Mathematical studies, Simulation, Lakes.

Lake water nutrient concentrations are strongly influenced by both inflowing nutrients and nutrients released from lake sediments. The problem of how the summer peak may be generated is considered, using actual data from two lakes in Japan. Lake Suwa is situated in the mountain district near the Nippon Alps. Three cities are located around it, and the district has a number of manufacturing industries and a large tourist industry. Lake Koyamaike is situated in the western district facing the Nippon Sea, which has the lowest population density in Japan. Although no factories and no big cities are located around it, the lake is polluted. A mathematical simulation indicates that the summer peak may be generated largely from nutrient material released from sediment. Using this approach, release rates have been calculated for the two lakes. Sediment removal seems to be an effective and immediate way to release the summer peak. (Moore-IVI)
W85-02098

URBAN RUNOFF AS A SOURCE OF POLYCYCLIC AROMATIC HYDROCARBONS TO COASTAL WATERS,
E. J. Hoffman, G. L. Mills, J. S. Latimer, and J. G. Quinn.
Environmental Science and Technology, Vol. 18, No. 8, p 580-587, August, 1984. 2 Fig, 6 Tab, 31 Ref. NOAA grant NA80RAD00047.

Descriptors: *Urban runoff, *Polycyclic aromatic hydrocarbons, *Water pollution sources, *Narragansett Bay, Coastal waters, Land use, Aromatic compounds, Hydrocarbons, Particulates, Rainfall, Storm runoff, Highways, Industrial areas, Residential areas.

Urban runoff samples collected from four storm drains, each serving a different land use, were analyzed for selected polycyclic aromatic hydrocarbons (PAHs) by gas chromatography. The PAH concentrations varied widely during the history of each storm and appeared to be most concentrated in first or second flushes. Higher molecular weight PAHs were mostly found associated with the particulates and were enriched on two different particle sizes, a small particle fraction and a larger particle fraction, perhaps from different sources. The annual input of PAHs to the upper Narragansett Bay watershed was calculated by using storm loads with local rainfall and land use data. The loads of PAHs (mass/(drainage area)/year) in urban runoff were higher at the highway and industrial land uses in comparison to the commercial and residential areas. Urban runoff PAHs are similar in composition to that found in atmospheric fallout but unlike the PAHs in municipal effluents. Comparison of urban runoff PAH inputs to other sources entering Narragansett Bay showed that urban runoff accounted for 71% of the total inputs for higher molecular weight PAHs and 36% of the total PAHs. (Author's abstract)
W85-02108

SOLUBILITY OF ORGANIC MIXTURES IN WATER,
Syracuse Research Corp., NY. Life and Environmental Sciences Div.
S. Banerjee.
Environmental Science and Technology, Vol. 18, No. 8, August, 1984. 9 Tab, 22 Ref. EPA grant R808613.

Descriptors: *Organic compounds, *Solubility, *Toxicity, Chlorobenzenes, Phase, Hydrophilicity, UNIFAC equation, Mixtures.

Environmental contaminants are frequently encountered as mixtures, and the behavior of a compound in a mixture may not correspond to that predicted from pure component data. The solubilities of several chlorobenzenes and other mixtures in water were determined. The results varied with the phase of the solute mixture and the hydrophilicity of the components and were interpreted through activity coefficients calculated by the UNIFAC equation. Mixtures of structurally related hydrophobic liquids were near ideal in the organic phase; in the aqueous phase the activity coefficient of a component was unaffected by the presence of cosolutes. Increasing hydrophilicity of the solutes led to deviations from ideality in the organic phase, but these could be largely accounted for by the UNIFAC equation. For mixtures of solids which did not interact, the components tended to behave independently of one another, and their solubilities were approximately additive. The behavior of mixtures of liquids and solids was intermediate between that of liquid mixtures and that of mixtures of solids. These conclusions are of particular relevance to toxicity studies in that they can be used to estimate limiting toxicities of mixtures. In the absence of biological interaction, the toxicity of a saturated solution derived from a mixture of liquids will be less than that of a corresponding saturated solution obtained from its most toxic component. The opposite argument applies for solids since their solubilities are roughly additive. (Moore-IVI)
W85-02109

CHARACTERISTICS OF LEACHATES FROM HAZARDOUS WASTE LANDFILLS,
Multidisciplinary Energy and Environmental Systems and Applications, San Pedro, CA.
M. Ghassemi, S. Quinlivan, and J. Bachmaier.
Journal of Environmental Science and Health, Vol. A19, No. 5, p 579-620, 1984. 12 Tab, 9 Ref. EPA contract 68-02-3174.

Descriptors: *Leachates, *Landfills, *Hazardous materials, Data base, Organic compounds, Inor-

ganic compounds, Land disposal, Liners, Water pollution sources.

A hazardous waste landfill leachate data base covering some thirty leachates from eleven disposal sites has been developed. The sites cover a range of sizes, liner designs, waste types and leachate collection systems and the leachate data cover a range of organic and inorganic constituents. For the cases included, the inorganic constituents appearing in highest concentrations in the leachate are iron, calcium, magnesium, cadmium, and arsenic, and the organic constituents appearing in highest concentrations are acetic acid, methylene chloride, butyric acid, 1,1-dichloroethane, and trichlorofluoromethane. The constituent concentrations in the leachate from hazardous waste landfills fall within the reported ranges for municipal landfill leachate. Based on preliminary data, only gross correlations could be made between leachate quality and waste input. (Author's abstract)
W85-02118

MICROBIAL DEGRADATION OF 2,4,6-TRICHLOROANILINE IN AQUATIC SAMPLES AND LABORATORY ENRICHMENT CULTURES,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
W. R. Mitchell, S. H. Hoke, and A. B. Rosencrance.
Journal of Environmental Science and Health, Vol. A19, No. 6, p 679-696, 1984. 2 Fig, 2 Tab, 28 Ref.

Descriptors: *Trichloroaniline, *Microbial degradation, *Canal Creek, *Maryland, Fate of pollutants, Anilines, Stream sediments, Microorganisms, Acclimation.

Canal Creek is a small stream at the Aberdeen Proving ground, MD, the sediments of which were believed to be contaminated with 2,4,6-trichloroaniline (2,4,6-TCA). Water samples containing bottom sediments were collected from Canal Creek near the mouth of its outflow to the Gunpowder River, and from four other sites near Frederick, MD, for purposes of comparison. Microorganisms present in water samples obtained from Canal Creek degraded 2,4,6-TCA following a prolonged acclimation period. Creek water sediments, but not the co-substrate aniline, reduced the lag time prior to degradation. The microorganisms in the samples could be enriched to grow on 2,4,6-TCA as indicated by increases in carbon dioxide, chloride, and adenosine triphosphate and by slight biomass increases accompanying the degradation of the compound. Uptake of 2,4,6-TCA by the enrichment population was as rapid as that of the original sample population but was without an apparent lag. Similar enrichment cultures could not be developed from five other sites. The lengthy acclimation period prior to 2,4,6-TCA degradation in the original creek water samples could indicate that the microorganisms present had not been exposed to the compound in sufficient quantity to bring about their adaption and enrichment as a natural population. (Moore-IVI)
W85-02120

SOME OBSERVATIONS ON THE CHEMICAL COMPOSITION OF PRECIPITATION IN AN INDUSTRIAL AREA AND IT'S USE IN AIR QUALITY ASSESSMENT,
Bhabha Atomic Research Centre, Bombay (India). Air Monitoring Section.
T. N. Mahadevan, V. Meenakshy, and A. P. Sathe.
Mausam, Vol. 35, No. 1, p 87-90, 1984. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Precipitation scavenging, *Pollutant identification, *Air pollution, *Chemical composition, *India, *Chemistry of precipitation, *Fallout, *Acid rain, Monitoring, Sulfur compounds, Stochastic Process, Sampling network.

Precipitation samples collected from seven sites situated in a major industrial region in Bombay during the 1980 monsoon period were analyzed for pH, S04, Cl, NO3, NH4, and F ion concentrations. Barring one site which showed predominately acid rains, samples from other sites were found to be alkaline in nature. Data obtained suggest a predominant SO4 excess at two of the sites where the prime source is SO2. Higher levels of fluoride and nitrate were found at four of the sites indicating a local source. SO4 and NH4 excesses are estimated with reference to their stoichiometric ratios. Fluoride deposition due to precipitation washout around the fertilizer industry is assessed and the overall results of the study discussed. (Author's abstract)
W85-02129

EFFECT OF SUBSTRATE CONCENTRATION AND ORGANIC AND INORGANIC COMPOUNDS ON THE OCCURRENCE AND RATE OF MINERALIZATION AND COMETABOLISM,
Cornell Univ., Ithaca, NY. Lab. of Soil Microbiology.
Y.-S. Wang, R. V. Subba-Rao, and M. Alexander.
Applied and Environmental Microbiology, Vol. 27, No. 6, p 1195-1200, June, 1984. 3 Fig, 3 Tab, 22 Ref.

Descriptors: *Mineralization, *Cometabolism, *Fate of pollutants, Metabolism, Organic compounds, Inorganic compounds, Natural waters, Carbamates, Chlorinated hydrocarbons.

Isopropyl N-phenylcarbamate (IPC) at 400 pg and 1 micro g/ml was mineralized in samples of sewage, but only the lower concentration was mineralized in lake water samples in a 50-day period. IPC at 1 micro g/ml disappeared from lake water, but it was converted to organic products. Mineralization of IPC at 400 pg/ml in lake water was enhanced by additions of inorganic nutrients or a mixture of nonchlorinated water pollutants but not by yeast extract of mixtures containing aromatic compounds or excretions of primary producers. The mineralization of 200 pg of 2,4-dichlorophenoxyacetate per ml of lake water was not affected by additions of low levels of yeast extract or compounds excreted by primary producers but was enhanced by low concentrations of mixtures of water pollutants. It is suggested that some chemicals that are found to be converted only to organic products, presumably by cometabolism, in tests using the concentrations commonly employed in laboratory evaluations may be mineralized at the lower concentrations prevailing in natural waters. (Author's abstract)
W85-02132

EFFECTS OF URBANIZATION ON FREQUENCIES OF OVERFLOWS AND POLLUTANT LOADINGS FROM STORM SEWER OVERFLOWS: A DERIVED DISTRIBUTION APPROACH,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
G. V. Loganathan, and J. W. Delleur.
Water Resources Research, Vol. 20, No. 7, p 857-865, July, 1984. 7 Fig, 4 Tab, 23 Ref, 1 Append. OWRT project OWRT-A-057 IND.

Descriptors: *Urban runoff, *Storm wastewater, *Water pollution sources, Storm sewer overflows, Storm runoff, River flow, Analytical models, Distribution, Urbanization, Biochemical oxygen demand.

On the basis of exponential density functions for volume of runoff, interevent time, and duration of runoff event and beta density for the rescaled pollutant (biochemical oxygen demand) concentration, and gamma density for river flow volumes during a critical period, new distributions are derived for overflow volumes and for quality of pollutant in the river after mixing with the untreated overflows of the overtaxed system. This is accomplished by means of hydrological relationships between different variables. The current data on runoff volume, duration of runoff events, etc., are transformed to account for future urbanization activities. The newly formed variables are used in the derivation of probability distributions for overflows and receiving body pollutant concentration after urbanization. The analytical model is compared with the simulation model 'STORM.' (Author's abstract)
W85-02152

FLUX-AVERAGED AND VOLUME-AVERAGED CONCENTRATIONS IN CONTINUUM APPROACHES TO SOLUTE TRANSPORT,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
For primary bibliographic entry see Field 2F.
W85-02153

CONTAMINANT TRANSPORT IN FRACTURED POROUS MEDIA: ANALYTICAL SOLUTION FOR A TWO-MEMBER DECAY CHAIN IN A SINGLE FRACTURE,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
E. A. Sudicky, and E. O. Frind.
Water Resources Research, Vol. 20, No. 7, p 1021-1029, July, 1984. 4 Fig, 14 Ref.

Descriptors: *Path of pollutants, *Geologic fractures, *Radioactive decay, *Porous media, *Chain decay, Advection, Diffusion, Adsorption, Radioisotopes, Radioactive half-life.

An analytical solution is presented for the problem of radionuclide chain decay during transport through a discrete fracture situated in a porous rock matrix. The solution takes into account advection along the fracture, molecular diffusion from the fracture to the porous matrix, adsorption on the fracture face, adsorption in the rock matrix, and radioactive decay. The solution for the daughter product is in the form of a double integal which is evaluated by Gauss-Legendre quadrature. Results show that the daughter product tends to advance ahead of the parent nuclide even when the half-life of the parent is larger. This is attributed to the effect of chain decay in the matrix, which tends to reduce the diffusive loss of the daughter along the fracture. The examples also demonstrate the neglecting the parent nuclide and modeling its daughter as a single species can result in significant overestimation of arrival times at some point along the fracture. Although the analytical solution is restricted to a two-member chain for practical reasons, it represents a more realistic description of nuclide transport along a fracture than available single-species models. The solution may be of use for application to other contaminants undergoing different types of first-order transformation reactions. (Author's abstract)
W85-02170

EFFECT OF CLEAR-CUT SILVICULTURE ON DISSOLVED ION EXPORT AND WATER YIELD IN THE PIEDMONT,
Georgia Univ., Athens. School of Forest Resources.
J. D. Hewlett, H. E. Post, and R. Doss.
Water Resources Research, Vol. 20, No. 7. p 1030-1038, July, 1984. 5 Fig, 5 Tab, 31 Ref.

Descriptors: *Clear-cutting, *Solute transport, *Water yield, *Piedmont, *Georgia, Water quality, Water pollution sources, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sodium.

A paired watershed experiment on Putnam County, Georgia, was carried out from 1973 to 1980 to determine the effects of a typical southern clear-cut operation on water quality, timing, and yield. This report shows that increases in monthly exports of dissolved N, P, K, Ca, Mg, Na, TKN, and total electrolytes were short-lived and less than 0.5 kg/ha/month and may therefore be considered minor for practical purposes. Stream water concentrations were mostly diluted by clear-cutting, but a monthly water yield increase of 1 to 2 cm flushed an extra 0.15 kg/ha/month of nitrate-nitrogen from the basin during a 2-year period following harvest. Twenty surrounding forested basins (7 to 165 ha in area) were sampled monthly for 1 year, showing that the experimental pair was representative of the general levels of dissolved ions in forested Piedmont streams. Results suggest that clear-cut silviculture in this region will neither reduce soil fertility by flushing ions into streams nor eutrophy stream water. (Author's abstract)
W85-02171

5C. Effects Of Pollution

ORGANIC WASTEWATER EFFECTS ON BENTHIC INVERTEBRATES IN THE MANAWATU RIVER,
Massey Univ., Palmerston North (New Zealand). Dept. of Biotechnology.
D. M. Suckling.
New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 3/4, p 263-270, 1982. 4 Fig, 1 Tab, 13 Ref.

Descriptors: *New Zealand, *Manawatu River, *Water pollution effects, *Benthos, *Invertebrates, Aquatic insects, Midges, Mayflies, Species diversity, Species composition, Agricultural runoff, Organic loading.

The effects of the 3 main wastewater discharges on the benthic fauna of the Manawatu River (New Zealand) were studied between March 1979 and January 1980. At least 4 replicate Surber samples were taken from each of 6 sites, on 5 occasions during this period. Deleatidium sp. (Ephemeroptera), Hydora sp. (Coleoptera), and the Chironomidae were the most useful indicator organisms, according to a ranking system based on the occurrence of significant differences ($P < 0.05$) between populations at different sites. These taxa exhibited significant differences between sites in about 70% of all inter-site comparisons, using Mann-Whitney U-tests. The Coefficient of Similarity was successful at summarizing the comparisons between the clean-water and down-stream sites, ranging between 95% similarity to the clean-water site for a recovery site in winter, and less than 10% similarity to the clean water site for the lower reaches in summer. It is suggested that relative indices may be more appropriate than absolute indices for measuring water pollution. Water quality, indicated by species diversity, was generally good (allowing for the effects of agricultural runoff), although midsummer organic loading induced marked changes in benthic species composition, including the disappearance of Deleatidium sp, from several sites. (Author's abstract)
W85-01632

IMPACT OF AN OIL FIELD EFFLUENT ON MICROBIAL ACTIVITIES IN A WYOMING RIVER,
National Fishery Research Lab., La Crosse, WI.
M. A. Heitkamp, and B. T. Johnson.
Canadian Journal of Microbiology, Vol. 30, No. 6, p 786-792, June, 1984. 2 Fig, 4 Tab, 19 Ref.

Descriptors: *Wyoming, *Little Popo Agie River, *Ecological effects, *Oil wastes *Oil fields, *Microbial studies, Hydrocarbons, Wastewater pollution, Species composition, Sediments, Water pollution effects.

The survival, functions, and physiological diversity of autochthonous sediment microbiota were examined in situ at five stations along the Little Popo Agie River, WY; one station above, one at, and three below a discharge point for oil wastewater from Union Oil Company's Dallas Field. Below the oil wastewater discharge point there were increases in electron-transport activity, carbon dioxide production, and microbial populations of heterotrophs, ammonifiers, hexadecane degraders, starch hydrolyzers, protein hydrolyzers, and sulfate reducers. At a station 1420 m below the discharge point, however, overall sediment microbial activities and all of the physiological groups of bacteria, except hexadecane-degrading microbiota, were at levels comparable with those at the control station above the discharge point. Similarly, mineralization of glucose, amino acids, hexanoic acid, and hexadecane was elevated at stations directly below the discharge point, but appeared to subside rapidly. Xenobiotic biodegradation potential of the sediments varied with the chemical and the sample location and was not directly related to oil residue levels in the sediment. Microorganisms thus appeared to maintain physiological diversity and increased in numbers and activity in a riverine environment that contained petroleum hydrocarbon concentrations known to be deleterious to freshwater fish and macrobenthic communities. (Author's abstract)
W85-01640

ACID PRECIPITATION AND SCIENTIFIC UNCERTAINTY PROBLEMS IN PROBABILITY,
Vermont Law School, South Royalton. Environmental Law Center.
F. C. Reed.
International Journal of Environmental Studies, Vol. 18, No. 2, p 77-84, 1982. 2 Fig, 60 Ref.

Descriptors: *Acid rain, *Ecosystems, *Environmental effects, Fuels, Public opinion, Education, Power plants, Industrial wastes.

Acid precipitation, for the purposes of this study, refers to man made acid precipitation resulting from fossil fuel combustion by power plants, automobiles, smelters and refineries. Through a series of logical steps and questions, various generally accepted facts about acid precipitation are presented. The burning of fossil fuel has produced acid rain at levels sufficient to allow rainfall to reach a very low pH in many global areas. This low pH rainfall contributes to changes in man-made areas and natural areas. The extent to which these changes are attributable to man-made acid rain is not easily separated from other man-made or natural inducers of change. The best attack on curing the problem is to treat the source, fossil fuel burning. Remedies such as lake liming, acid resistant fish breeding programs, genetic engineering programs to give species adapted to acid conditions, are at best only stop-gap measures. (Baker-IVI)
W85-01665

ECONOMICS OF ACID RAIN: AN INVISIBLE HAND OF CONTROL,
Vermont Law School, South Royalton. Environmental Law Center.
A. H. Gilbert.
International Journal of Environmental Studies, Vol. 18, No. 2, p 85-90, 1982. 1 Fig, 18 Ref.

Descriptors: *Acid rain, *Economic analysis, *Electric powerplants, *Electric power costs, Costs, Economic aspects, Air pollution, Electric power production.

Economics currently plays an insignificant role in the control of acid rain. Economists have fallen into the old familiar pattern of evaluating the impacts of acid rain instead of developing economic techniques for controlling the source of its emission. Power generating plants and other major producers of acid rain discharge their oxide wastes into the air in order to reduce production costs. This cost saving enables the producer to increase profits and expand production at the expense of those who suffer from acid rain. The solution to this misallocation requires the internalization of all production costs. The price of the product will then reflect its true cost. Acid rain will be eliminated and resources will be more efficiently allocated. Economists will not have to attempt to evaluate the impossible nor trace its untraceable origin. Acid rain will no longer threaten our survival. (Author's abstract)
W85-01666

POLLUTION EFFECTS MONITORING WITH FORAMINIFERA AS INDICES IN THE THANA CREEK, BOMBAY AREA,
National Inst. of Oceanography, Panaji (India).
M. G. A. P. Setty.
International Journal of Environmental Studies, Vol. 18, No. 3/4, p 205-209, 1982. 1 Fig, 1 Tab, 5 Ref.

Descriptors: *Thana Creek, *Bombay, *India, *Foraminifera, *Bioindicators, *Water pollution effects, Protozoa, Benthic fauna, Benthos, Aquatic life.

Thana Creek, which flows through Bombay, India, into the Arabian Sea, has a very low fresh water inflow. The creek's temperature, salinity, depth, and tidal range are drastically affected by heavy discharges of effluents from factories located on either side of the creek. Benthonic foraminifera in sediments from the most upstream sampling stations are very small, embryonic and dull, and appear to be highly corroded having a very low (5-10 taxa in 1 gram dry weight sediment) distribution. The species diversity and the total foraminiferal number is high at the lower stations, compared to the upper stations, and include both embryonic and adult forms. Ostracoda are rare at the most upstream station and are common at the down stream stations. In the study area, the pollution effect on the foraminiferids is intense, hence highly reliable and measurable. The relative sensitivity of tolerance of the biota is sharply variable and dependent upon the nature of the pollutants discharged. The degree of pollution of this environment can be monitored through delineation of zones of effects of pollution. (Collier-IVI)
W85-01671

INFLUENCE OF PHYSICO-CHEMICAL FACTORS ON THE COLIFORM BACTERIA IN A CLOSED-LAKE WATER SYSTEM,
Jawaharlal Nehru Univ., New Delhi (India). Microbiological Lab.
For primary bibliographic entry see Field 2H.
W85-01672

GEOCHEMISTRY OF WELL WATER AND CARDIOVASCULAR DISEASES IN SRI LANKA,
Sri Lanka Univ., Peradeniya. Dept. of Geology.
C. B. Dissanayake, A. Senaratne, and S. V. R. Weerasooriya.
International Journal of Environmental Studies, Vol. 19, No. 3/4, p 195-203, 1982. 9 Fig, 1 Tab, 10 Ref.

Descriptors: *Sri Lanka, *Cardiovascular diseases, *Geochemistry, *Well water, Hardness, Epidemiology, Public health, Hypertensive diseases, Trace elements.

Clear correlations between water hardness and heart diseases have been observed in many countries. A survey carried out on the incidence of cardiovascular diseases in Sri Lanka in relation to the hardness of drinking water reveals that a correlation exists which is geographically related. There is a broad correlation indicating a low incidence of cardiovascular diseases when the water hardness reaches appreciable values. A clear-cut association cannot be expected, since other factors also appear to be involved. A case in point are the high hypertensive diseases and death rates in the North Central Province, even though the water hardness is high enough to prevent such a high incidence. The broad correlation cannot be considered as a causal relationship and other factors possibly exist that could also play a major role in the incidence of cardiovascular diseases, e.g. type and quantity of trace elements in the water. (Collier-IVI)
W85-01674

DISTRIBUTION AND PERIODICITY OF TOTAL, FAECAL COLIFORM BACTERIA IN AN AQUATIC ECOSYSTEM,
Jawaharlal Nehru Univ., New Delhi (India). Microbiological Lab.
For primary bibliographic entry see Field 5B.
W85-01675

MODELING ALGAL BEHAVIOUR IN THE RIVER THAMES,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 5G.
W85-01720

GROWTH OF CLADOPHORA GLOMERATA IN A RIVER RECEIVING SEWAGE EFFLUENT,
Southern Water Authority, Chatham (England). Kent Div.
J. R. Wharfe, K. S. Taylor, and H. A. C. Montgomery.
Water Research, Vol. 18, No. 8, p 971-979, 1984. 5 Fig, 3 Tab, 12 Ref.

Descriptors: *River Great Stour, *England, *Cladophora, *Phosphorus, Effluents, Water pollution effects, Limiting nutrients, Aquatic plants, Wastewater treatment, Phosphorus removal.

The River Great Stour is one of the principal rivers in Kent, England and provides a valuable fishery and amenity asset. There was a deterioration of the flora in the 1950s, with dense growths of Cladophora and the disappearance of some rooted macrophytes. A considerable improvement in the natural flora of the River Great Stour has occurred since the mid-1960s when a new sewage treatment works was commissioned at Ashford. A vegetation mapping program undertaken from 1978 to 1982 to assess the influence of the sewage treatment works discharge on the growth of the filamentous alga. Observation on the growth of Cladophora in the river suggest that dissolved phosphorus concentration are not normally limiting, especially as vigorous growths occurred on some occasions at location upstream from the sewage treatment works discharge. Previous recommendations to reduce dissolved phosphorus concentrations in the final effluent of the Ashford facility need not be implemented. The amenities of the river will be better preserved by maintaining the present practices in weed cutting and by continuing to provide a high standard of conventional treatment at Ashford sewage treatment works. (Moore-IVI)
W85-01723

TOXICITY OF CHLORINE TO A COMMON VASCULAR AQUATIC PLANT,
National Park Service, Washington, DC. Ecological Services Lab.
C. H. Watkins, and R. S. Hammerschlag.
Water Research, Vol. 18, No. 8, p 1037-1043, 1984. 3 Fig, 3 Tab, 19 Ref.

Descriptors: *Myriophyllum, *Chlorine, *Phytotoxicity, Aquatic plants, Chlorophyll a, Effluents, Chlorination, Water pollution effects.

Myriophyllum spicatum was exposed to various chlorine concentrations on a continuous and intermittent basis in 96-h toxicity studies utilizing a proportional diluter. Continuous exposure to chlorine concentrations as low as 0.05 mg/l total residual chlorine (TRC) depressed shoot and total plant dry weights approx. 30% relative to controls. Shoot length was depressed approx. 16% at this concentration. Chlorophyll a was depressed 25% at 0.1 mg/l TRC. However, intermittent exposure of plants to chlorine for three 2-h periods daily for 96 h indicated an insensitivity to repeated short term chlorine exposure at all concentrations but 1.0 mg/l TRC. These results indicate that high level chlorine discharges from waste water facilities and electric generating plants could be a contributing factor impacting nearby submerged aquatic vegetation. (Author's abstract)
W85-01731

OCCURRENCE OF THE ASIATIC CLAM CORBICULA FLUMINEA IN THE MAUMEE RIVER AND WESTERN LAKE ERIE,
Toledo Edison Co., OH.
J. Scott-Wasilk, G. G. Downing, and J. S. Lietzow.
Journal of Great Lakes Research, Vol. 9, No. 1, p 9-13, 1983. 2 Fig, 2 Tab, 23 Ref.

Descriptors: *Corbicula, *Maumee River, *Lake Erie, *Thermal pollution, Clams, Powerplants, Heated water, Effluents, Ecological distribution, Biofouling.

Under certain conditions the Asiatic clam may pose a significant biofouling threat to powerplants due to colonization and subsequent blocking of raw water systems. Surveys of the occurrence of the clam were conducted in the thermal plumes of three electric generating facilities in western Lake Erie. The Asiatic clam was found in only two locations along the southern shore of the western basin of Lake Erie: the thermal plume areas of the two coal-fired power plants with once-through condenser cooling systems. Three sewage treatment plant outfalls were sampled, but Corbicula were found only in the sewage treatment plant outfall that was within the thermal plume of a power plant. No Corbicula were found in the vicinity of the nuclear power plant which had a closed-cycle natural draft cooling tower, and hence no significant thermal plume. The oldest specimens are at least 3 yr old, indicating that the clam probably has been established in in the region since 1978. The Great Lakes are farther north than the natural range of this clam, and prolonged cold temperatures in this region may be responsible for the confinement of this clam to baseload power plants with continuous thermal plumes. Those industries or municipalities which have a continuous discharge of water which is always above 4.5 C may find it useful to determine if the clam is present in their plume areas. (Moore-IVI)
W85-01753

ACCUMULATION OF THE TRACE ELEMENTS LEAD AND ZINC BY ASELLUS COMMUNIS AT THREE DIFFERENT PH LEVELS,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5B.
W85-01795

RESPONSE OF ALGAL POPULATIONS TO CHANGES IN STREAM WATER QUALITY,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Biological Sciences.
F. B. Trama.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202464, Price codes: A02 in paper copy, A01 in microfiche. Center for Coastal and Environmental Studies Completion Report, February 1984. 15 p, 5 Fig, 7 Tab, 11 Ref. Project No. OWRT A-061-NJ(1), Contract/Grant No. 14-34-0001-1132.

Descriptors: *Bioassay, *Selenastrum, Eutrophication, Streams, Stream pollution, *Algal assay, Dialysis cells, Semipermeable membranes, *Biomonitoring, *Chlorophyta.

A custom-made dialysis cell and a commercially available clear plastic chamber (Biomonitor) with a semipermeable membrane were tested as potentially more useful and reliable than the closed flasks employed in the widely adopted EPA Algal Assay: Bottle Test procedure. The dialysis cell failed to attain equilibrium with an external medium within a 60 hour period. The Biomonitor attained equilibrium within 60 hours but not with respect to soluble inorganic phosphorus. The growth response of natural plankton or a green alga, Selanastrum capricornutum, in Biomonitors under laboratory and in situ conditions showed that the Biomonitor produced results which were more variable and erratic than those obtained using a modified Algal Assay: Bottle Test procedure. Use of chlorophyll a to estimate algal biomass increased the variance by an order of magnitude in comparison to estimates from cell counts and mean cell volumes. Biomonitors proved to be more costly to use, less reliable, and subject to greater variation than the closed flask procedure. No significant improvement was found by employing semipermeable test chambers under laboratory or field conditions when compared to results from the modified EPA Algal Assay: Bottle Test procedure.
W85-01797

ANALYSIS OF POLLUTANT ENHANCED BACTERIAL BLUE-GREEN ALGAL INTERRELATIONSHIPS POTENTIATING SURFACE WATER CONTAMINATION BY NOXIOUS BLUE-GREEN ALGAL BLOOMS,
Nevada Univ., Reno. Dept. of Biology.
G. W. Bedell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202498, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Center Completion Report, February 1984. 10 p, 1 Tab, 8 Ref. Project No. OWRT A-102-NEV(1), Contract/Grant No. 14-34-0001-2130.

Descriptors: *Algae, Bacteria, *Sulfur bacteria, *Eutrophication, Reservoirs, Alkaline water, Cyanophyta, Anabaena, Desulfovibro.

Sulfate-reducing bacteria from the genus Desulfovibro can stimulate the blue-green alga (Cyanobacterium) Anabaena variabilis (Strain 6411) into increasing its dry weight biomass production by more than 200 percent over that of the control as the total phosphate in the medium approaches zero. Methods which utilize total nitrogen to phosphorus ratios in waters as predictors of blue-green algal 'blooms' may be unreliable when the waters are very low in phosphorus yet remain high in sulfate with conditions favorable for sulfate-reducing bacterial growth in benthic sediments. In high sulfate containing waters that are alkaline and that are low in both nitrogen and phosphate, blue-green algal blooms will prevail unless some steps are taken to control the growth of the bacteria. Otherwise, if the phosphate levels alone in the aqueous systems are reduced below threshold levels under these conditions, the magnitude of the blue-green algal blooms may be increased substantially. These data should be considered by those who will be making policy at the federal, state, or local levels, regarding the total removal of phosphorus from wastewaters or from certain aqueous systems. The data may be important for considering the effects of acid rain as well.
W85-01803

INFLUENCE OF ACID PRECIPITATION ON STREAM INVERTEBRATES,
Michigan State Univ., East Lansing. Dept. of Zoology.
T. M. Burton, and J. W. Allan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-190073, Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Research Completion Report, September, 1983. 25 p, 4 Fig, 4 Tab, 19 Ref. Project No. OWRT A-120-MICH(1), Contract/Grant No. 14-34-0001-2124.

Descriptors: *Invertebrates, Caddisflies, Isopods, Snails, Stoneflies, Acid streams, *Aluminum, *Toxicity, Asella, Lepidostoma, Pycnopsyche, Physa, Nemoura, *Acid rain, Water pollution effects, *Hydrogen ion concentration.

Five species of invertebrates, Asellus intermedius an isopod, Lepidostoma liba and Pycnopsyche sp., two species of caddisflies, Physa heterostropha, a snail, and a Nemoura sp., a stonefly, were tested for 30 days in 5 separate experiments for susceptibility to acidification to pH 4.0 and pH 5.0 alone or in combination with 250 to 500 micrograms Al/l. The effects of organic matter on the susceptibility of these invertebrates to acidification and aluminum toxicity were also tested. Acidification alone of natural stream water to pH 4.0 resulted in significant mortality for all 5 species. The addition of 500 micrograms Al/l significantly increased this mortality. Experiments with distilled water with inorganic chemistry adjusted to simulate natural stream water demonstrated that the absence of organic matter strongly resulted in much greater aluminum toxicity at low pH's and in somewhat greater susceptibility to acidification alone. The addition of citrate as an organic ligand decreased this effect. Experiments conducted at pH 5.0 with 250 micrograms Al/l added to natural stream water demonstrated that no significant mortality occurred. Thus, acidification effects for these 5 species for 30-day exposure periods only occurred at pH levels less than pH 5 and at aluminum levels greater than 250 micrograms Al/l. The threshold for effects, thus, was between pH 5 and pH 4 and between 250 and 500 micrograms Al/l.
W85-01807

EFFECTS OF THE HERBICIDE ATRAZINE ON AN OYSTER-FOOD ORGANISM,
Maryland Univ., College Park. Dept. of Botany.
E. P. Karlander, J. M. Mayasich, and D. E. Terlizzi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-190172, Price codes: A03 in paper copy, A01 in microfiche. Maryland Water Resources Research Center Publication No. 73, August 1983. 20 p, 3 Tab, 35 Ref. Project No. OWRT A-060-MD(1), Contract/Grant No. 14-34-0001-2122.

Descriptors: *Triazine pesticides, *Temperature, *Light intensity, *Herbicides, *Atrazine, Oysters, Algae, *Growth rates, Phytoplankton, Algal growth, Chesapeake Bay, *Maryland, Agricultural runoff, *Nannochloris oculata, Fish food organisms, Toxicity.

Growth rates of semicontinuous cultures of Nannochloris oculata (Chesapeake Bay clone) were determined in repeated experiments each featuring 27 treatment combinations of temperature, light, and the herbicide atrazine. All interactions two-way and three-way, were significant. This indicated the main effects did not act independently to produce the response for a given treatment. Further analysis of the interactions showed that they were largely linear in nature. Atrazine's toxicity was maximized when temperature and light conditions were optimal for rapid growth. The percent inhibition for atrazine at 100 ppb ranged from 46.2% at low temperature (15 C) and low light (0.208 mW/cm) to 54% at high temperature (25 C) and high light (1.352 mW/cm). The dependency of atrazine's toxicity on temperature and light stresses the need for incorporating these and other important environmental variables into future laboratory and field studies which investigate the effects of herbicide runoff on non-target organisms in the Chesapeake Bay.
W85-01808

EFFECTS OF RUNOFF FROM UNDEVELOPED VERSUS LIGHTLY DEVELOPED WATERSHEDS ON TROPICAL PLANKTONIC ECOSYSTEM,
Caribbean Research Inst., St. Thomas, VI.
T. W. Purcell, III, and M. J. Canoy.
Technical Report No. 17, September 1983. 56 p, 2 Append. Project No. OWRT A-013-VI(1), Contract/Grant No. 14-34-0001-1150.

Descriptors: Runoff, Tropical waters, Plankton, *Marine water quality, Mangroves, *Virgin Islands, St. Thomas, Watershed development, Ecological impact, Water pollution control, Great Cruz Bay.

Two watersheds on the island of St. Thomas were studied to determine the effects of development on the quality of runoff water into the bays and to assess the effects of this runoff on the bay waters and plankton communities. The plankton communities studies were phytoplankton, zooplankton, and Ichthyoplankton. It was found that PO4 and NO3 were key nutrients, and turbidity a limiting physical effect. These, where they reached the bays, had a notable but not direct effect on the plankton production and dynamics. A key element in controlling the effect was whether or not the normal salt pond mangrove system was left intact.
W85-01810

LIMNOLOGY IN RESERVOIRS ON THE COLORADO RIVER,
Nevada Univ., Las Vegas. Lake Mead Limnological Research Center.
For primary bibliographic entry see Field 2H.
W85-01812

POTENTIAL FOR ACIDIFICATION OF SIX REMOTE PONDS IN THE WHITE MOUNTAINS OF NEW HAMPHIRE,
Northeastern Forest Experiment Station, Durham, NH.
For primary bibliographic entry see Field 5B.
W85-01834

EFFECTS OF AMMONIUM EFFLUENTS ON PLANKTONIC PRIMARY PRODUCTION AND DECOMPOSITION IN A COASTAL BRACKISH WATER ENVIRONMENT. I. INTERRELATIONS BETWEEN ABIOTIC AND BIOTIC COMPONENTS OF THE PLANKTONIC ECOSYSTEM,
Helsinki Water District (Finland).
T. Tamminen.
Netherlands Journal of Research, Vol. 15, No. 3/4, p 349-361, December, 1982. 3 Fig, 3 Tab, 19 Ref.

Descriptors: *Water pollution effects, *Ammonium, *Estuaries, *Finland, *Baltic Sea, Ecosystems, Plankton, Chlorophyll, Primary productivity, Brackish water, Heterotrophic activity.

The study area was located at the southern coast of Finland, the Baltic Sea. Interactions between abiotic and biotic components of the planktonic ecosystem in the ammonium-loaded archipelago area were studied. Gradients of chlorophyll a, primary productivity and heterotrophic activity evolved around the discharge site. Multivariate analyses described typical stages in the succession of the planktonic community. A pronounced heterotrophic phase was observed, which referred especially to the innermost research area. Since acute stimulations of heterotrophic activity were observed only exceptionally in effluent tests, planktonic and benthic primary production and sediment metabolism were considered as mediators of effluent effects on heterotrophy. (Baker-IVI)
W85-01840

ANNUAL CYCLE OF KEPONE RESIDUE AND LIPID CONTENT OF THE ESTUARINE CLAM, RANGIA CUNEATA,
Virginia State Water Control Board, Richmond. Div. of Ecological Studies.
C. A. Lunsford, and C. R. Blem.
Estuaries, Vol. 5, No. 2, p 121-130, June, 1982. 5 Fig, 4 Tab, 17 Ref.

Descriptors: *Kepone, *Lipids, *Clams, *Rappahannock River, *James River, *Virginia, Water pollution effects, Pesticides, Salinity, Hydrogen ion concentration, Water temperature.

Factors affecting Kepone uptake and lipid content of the clam, Rangia cuneata, were tested over a 12 month study. Clams obtained from the Rappahannock and James Rivers were held in submersible live boxes at two sites in the James River estuary and were sampled monthly from September 1978 through August 1979. Clams held in the freshwater zone near the source of Kepone contamination (Hopewell, Virginia) generally had higher Kepone and lipid content than those held downstream in the oligohaline zone. Significant differences in Kepone content between test sites and months are largely, but not entirely, a function of ambient water temperature, dissolved oxygen, amount of lipid in the clam, turbidity, Kepone content of the water column and duration of exposure. Lipid content of clams varied significantly between test sites, river of origin and months and is significantly related to salinity, ambient water temperature, pH and duration of exposure. Kepone content was more closely correlated with total lipid stores of clams than any other real variable. This association may be due to lipid reserves acting as a storage site for Kepone, but may also be interpreted as the result of selection against clams lacking lipid stores that might act as reservoirs for Kepone thus protecting more delicate tissues. (Author's abstract)
W85-01844

RESPONSES OF DEVELOPING ESTUARINE MACROBENTHIC COMMMUNITIES TO DRILLING MUDS,
Environmental Research Lab., Gulf Breeze, FL.
M. E. Tagatz, J. M. Ivey, C. E. DalBo, and J. L. Oglesby.
Estuaries, Vol. 5, No. 2, p 131-137, June, 1982. 2 Fig, 3 Tab, 18 Ref.

Descriptors: *Benthic animals, *Estuarine environment, *Drilling muds, Water pollution effects, Zooplankton, Tunicates, Mollusks, Annelids, Growth.

The effects of drilling mud, used in oil drilling operations, on development of estuarine macrobenthic communities from settling planktonic larvae were assessed by comparing numbers and species of animals that grew in uncontaminated and contaminated aquaria for 8 weeks. Aquaria contained sand and were continuously supplied unfiltered seawater. Seven lignosulfonate-type drilling muds obtained from an active exploratory platform in estuarine waters were tested consecutively at nominal concentrations of 0.5, 5, and 50 parts per million (ppm) in the water column. Numbers of tunicates, mollusks, and annelids per aquarium were significantly (alpha = 0.05) decreased from control numbers in 50 ppm. Structural differences in communities exposed to 50 ppm from those in the control and lower concentrations were indicated by a decrease in Spearman's measure of rank correlation of species abundance and an increase in the Shannon-Weaver index of species diversity. A total of 13 species occurred in 50 ppm compared to 23 species in each of the other situations. Growth in diameter of Molgula manhattensis was significantly affected in all concentrations of mud. (Author's abstract)
W85-01845

ACUTE TOXICITY OF KEPONE TO SELECTED FRESHWATER FISHES,
Virginia Inst. of Marine Science, Gloucester Point.
M. H. Roberts, Jr., and R. E. Bendl.
Estuaries, Vol. 5, No. 3, p 158-164, September, 1982. 1 Fig, 5 Tab, 14 Ref.

Descriptors: *Kepone, *Pesticide toxicity, *Fish, *James River, *Virginia, Toxicity, Eel, Elvers, Immature growth stages, Catfish, Bluegill, Bioaccumulation.

The maximum concentration of a compound which can occur dissolved in water without causing long-term effects for various species, called the maximum acceptable toxicant concentration (MATC), can be estimated for the 96-h LC50 if the application factor is known for at least one species. The acute toxicity of Kepone in freshwater was determined with three fish species occurring in the James River; Ictalurus punctatus (channel catfish), Lepomis macrochirus (bluegills), and Anguilla rostrata (American eel). Elvers of A. rostrata were most sensitive with a 96 h lethal concentration for 50% of the animals tested (LC50) of 35 micro g per l. Bluegills were slightly less sensitive with a 96 h LC50 of 50 micro g per l. Catfish were most tolerant with a 96 h LC50 of 514 micro g per l. Bluegills and catfish exposed to comparable concentrations of Kepone accumulated equivalent amounts in 96 h. Using an application factor of 0.004, the calculated MATC's for elvers, bulegills, and channel catfish are estimated to be 0.14, 0.20, and 2.0 micro g per liter or above, respectively. These values are all well above the 5 ng per l observed in water samples for the James River near Skiff's Creek. (Moore-IVI)
W85-01846

DEVELOPMENT OF THE CONDITION OF THE BALDEGGERSEE (1900 TO 1980) AND THE EFFECT OF INTRALAKE PROCEDURES (DIE ZUSTANDSENTWICKLUNG DIS BALDEGGERSEES (1900 BIS 1980) UND DIE AUSWIRKUNG VON SEEINTERNEN MASSNAHMEN),
P. Stadelmann.
Wasser, Energie, Luft, Vol. 76, No. 5/6, p 85-95, 1984. 15 Fig, 7 Tab, 70 Ref.

Descriptors: *Baldeggersee, *Switzerland, *Eutrophication, Fish, Phytoplankton, Destratification, Lake restoration, Fishkills, Supersaturation, Dissolved oxygen, Limnology, Aeration, Water circulation, Aerobic conditions.

The eutrophication of the Baldeggersee in Switzerland is demonstrated by changes in the fish and phytoplankton populations and by the results of limnological studies. In 1900, the lake was oligotrophic and contained many fish. By 1940, carp were the predominant species of fish. Since the 1950s, episodes of fish mortality have demonstrated oxygen supersaturation in the surface layer of the lake and oxygen deprivation in the depths. Oscillatoria rubescens was predominant from 1900 to 1965 but disappeared with increasing eutrophication. Eutrophication reached a maximum around 1975. Phosphorus concentration in spring reached 500 mg total P/cu m, and primary production was 420 g C/sq m/yr. Increased levels of ammonium, sulfide, methane, and manganese were found in the hypolimnion. External measures were able to reduce phosphorus input only by 50% and at too

slow a rate. Artificial circulation of the lake in winter to achieve destratification and oxygen aeration in summer were therefore carried out. The first artificial circulation was performed in February 1982 and lasted 2 mo; after 2 wk, an even distribution of temperature and oxygen was achieved. Sulfide disappeared in deep water after the first circulation. The introduction of 4.5 tonnes O2/day into deep water in summer 1983 resulted in aerobic conditions year-round throughout the entire lake. In fall, the highest oxygen levels ever recorded were found. Sulfide and methane could not be measured, and ammonium and manganese were found in lower concentrations. External procedures brought phosphorus input down to 250 mg/cu m the following spring. (Gish-IVI)
W85-01865

EFFECTS OF THE HERBICIDE ATRAZINE ON ADENINE NUCLEOTIDE LEVELS IN ZOSTERA MARINA L. (EELGRASS),
Virginia Inst. of Marine Science, Gloucester Point.
D. A. Delistraty, and C. Hershner.
Aquatic Botany, Vol. 18, No. 4, p 353-369, June, 1984. 9 Fig, 4 Tab, 32 Ref. EPA grants R805953 and X003245.

Descriptors: *Adenine nucleotides, *Eelgrass, *Atrazine, *Phytotoxicity, Water pollution effects, Herbicides, Adenylates, Productivity, Plant physiology, Macrophytes.

Response of adenine nucleotides (ATP, ADP, AMP) and adenylate energy charge (EC) to atrazine, a triazine herbicide, was evaluated as an indicator of metabolic state in Zostera marina L. (eelgrass), a submerged marine angiosperm. Short-term (6 h) atrazine stress reduced ATP and total adenylates (AT) at both 10 and 100 ppb, but EC remained constant. Net productivity decreased at 100, but not at 10 ppb atrazine over 6 h. Long-term (21 day) atrazine stress was evidenced by growth inhibition and 50% mortality near 100 ppb. EC was reduced at 0.1, 1.0 and 10 ppb atrazine, but ATP, and EC increased with physiological response to severe stress (100 ppb) after 21 days. Apparently, ATP and AT decrease over the short-term but rebound over the long-term with severe atrazine stress, increasing beyond control levels before plant death results. Supplementing adenine nucleotide and EC results with more conventional quantitative analyses should afford greater knowledge of physiological response to environmental variation. Author's abstract)
W85-01888

IMPACT OF ACIDIFICATION AND EUTROPHICATION ON MACROPHYTE COMMUNITES IN SOFT WATERS. II. EXPERIMENTAL STUDIES,
Katholieke Univ. Nijmegen (Netherlands). Lab. of Aquatic Ecology.
J. G. M. Roelofs, J. A. A. R. Schuurkes, and A. J. M. Smits.
Aquatic Botany, Vol. 18, No. 4, p 389-411, June, 1984. 9 Fig, 10 Tab, 27 Ref.

Descriptors: *Acidification, *Eutrophication, *Macrophytes, *Soft water, *Netherlands, Nutrients, Aquatic plants, Phosphates, Nitrogen, Carbon dioxide, Alkalinity, Ammonium.

In The Netherlands, there has been a dramatic decline during the last 30 years in the number of stands belonging to the phytosociological alliance Littorellion. Generally, the communities classified within this alliance occur in poorly buffered, oligotrophic waters, with very low phosphate, nitrogen and carbon dioxide levels in the water layer and considerably higher nutrient levels in the sediment. The plant species dominating these communities are isoetids such as Littorella uniflora (L.) Aschers., Lobelia dortmanna L. and Isoetes lacustris L., which show various adaptations to make successful growth possible under these conditions. Field observations showed that the waters where Littorella uniflora had disappeared or strongly decreased could be divided into two groups. A major group (77%) was characterized by the presence of submerged Juncus bulbosus L. and/or Sphagnum species. These waters appeared to be strongly acidified (pH < 4.5) and had increased nitrogen levels with ammonium as the dominant N-source. Within this group, the waters with luxuriant growth of J. bulbosus and/or Sphagnum spp. had strongly increased carbon dioxide levels in both sediment and water. Different types of experiments proved casual relationships between the observed changes in macrophytes and the changed physicochemical parameters. Ecophysiological experiments showed that J. bulbosus lacks the typical adaptations of the isoetid plant species, i.e. it uses very low amounts of sediment-CO2 and releases only a little oxygen from the roots. However, J. bulbosus is more able than Littorella uniflora to use CO2 from the water layer. From the nutrient-uptake experiments, the decreased nitrate and increased ammonium levels seem to be favorable to J. bulbosus. The culture experiments clearly demonstrated that the biomass of J. bulbosus only increased strongly when the sediment was poorly buffered and the pH of the water was low. When combining factors like CO2 enrichment of the sediment, with and without phosphate, and/or ammonium enrichment of the water in the culture experiments, it is clearly shown that phosphate and/or ammonium enrichment without CO2 enrichment do not lead to an increase in biomass of J. bulbosus. Therefore, it is obvious that the changes in the macrophyte community can be ascribed primarily to changes in the carbon budget as a result of acidification. A minor group of waters (23%) was characterized by the absence of submerged J. bulbosus and/or Sphagnum spp. In most of these waters, submerged plant species occurred, such as Myriophyllum alterniflorum DC or non-rooted species such as Riccia fluitans L. These waters were not acidified, and generally had an increased alkalinity and higher nitrogen and phosphate levels of sediment and/or water. Culture experiments showed that phosphate enrichment of the sediment alone leads to luxuriant growth of submerged macrophyte species such as M. alterniflorum, whereas phosphate enrichment of both sediment and water leads to mass development of non-rooted plant species such as R. fluitans. (Author's abstract)
W85-01889

TROPHIC RESPONSE OF FISHES TO HABITAT VARIABILITY IN COASTAL SEAGRASS SYSTEMS,
Florida State Univ., Tallahassee. Dept. of Biological Science.
For primary bibliographic entry see Field 2L.
W85-01890

TERRESTRIAL RUNOFF AS A CAUSE OF OUTBREAKS OF ACANTHASTER PLANCI (ECHINODERMATA: ASTEROIDEA),
Guam Univ., Agana. Marine Lab.
C. Birkeland.
Marine Biology, Vol. 69, No. 2, p 175-185, August, 1982. 2 Fig, 4 Tab, 75 Ref.

Descriptors: *Runoff, *Acanthaster, *Marine environment, *Phytoplankton, Eutrophication, Typhoons, Drought, Guam, Micronesia, Polynesia, Nutrients, Bays, Rainfall.

Outbreaks of adult Acanthaster planci (Linnaeus) have appeared at irregular intervals, arriving 3 yrs after heavy rains (> 100 cm in 3 months) following droughts (< 25 cm in 4 months) or 3 yrs after rains exceeding intensities of 30 cm in 24 h. Outbreaks of A. planci follow typhoons that bring heavy rains, but do not follow 'dry' typhoons of equivalent wind force. Outbreaks occur around the high islands in Micronesia and Polynesia, but not around the atolls at intermediate locations. Phytoplankton blooms appear off high islands at the beginning of the rainy season in bays with large watersheds and with sufficient residence time of the waters: these are the initial sites of A. planci abundance on Guam. The spawning seasons of A. planci occur at the beginning of the rainy season on both sides of the equator. It is hypothesized that, on rare occasions, terrestrial runoff from heavy rains (following the dry season or a record drought) may provide enough nutrients to stimulate phytoplankton blooms of sufficient size to produce enough food for the larvae of A. planci. The increased survival of larvae results in an outbreak of adults 3 yrs later. This hypothesis can be tested by predicting future outbreaks. An outbreak of A. planci on Saipan in the summer of 1981 was predicted on the basis of heavy rains in August 1978. (Author's abstract)
W85-01893

HEPATIC MIXED-FUNCTION OXIDASES IN CALIFORNIA FLATFISHES ARE INCREASED IN CONTAMINATED ENVIRONMENTS AND BY OIL AND PCB INGESTION,
Lawrence Livermore National Lab., CA.
For primary bibliographic entry see Field 5A.
W85-01894

ENVIRONMENTAL AND BIOCHEMICAL INVESTIGATION OF SOME EFFECTS OF ORGANIC POLLUTION IN INNER OSLOFJORD, NORWAY,
Dunstaffnage Marine Research Lab., Oban (Scotland).
J. Blackstock, and C. Filion-Myklebust.
Marine Biology, Vol. 73, No. 2, p 155-163, 1983. 2 Fig, 5 Tab, 22 Ref.

Descriptors: *Oslofjord, *Norway, *Polychaetes, *Water pollution effects, Enzymes, Dissolved oxygen, Carbon, Nitrogen, Redox potential, Monitoring, Organic compounds, Sediments, Fjords.

Coordinated environmental monitoring and biochemical studies of the polychaete Glycera alba (Muller) have been applied to the assessment of the impact of inputs of organically rich waste material into Inner Oslofjord. Six sampling stations at intervals of 5 km on a transect extending from Lysakerfjord, 5 km from Oslo harbor, to Vollengropen, a few kilometers from the Drobak sill were used in the investigation. Samples of water, sediment and biological material were collected from these sampling stations on one occasion, in September 1980. On the basis of dissolved oxygen content of the water column near the sediment surface, carbon and nitrogen contents and redox potential (Eh) in the sediments, the greatest impact of organic enrichment was found at Lysakerfjord. Localized variations in sediment condition were, however, pronounced in the transect. Maximal activities of 4 enzymes associated with energy-yielding metabolism were estimated in 7 to 11 individual G. alba from each sampling station. Relatively low activities of the glycolytic enzyme phosphofructokinase in the group of G. alba from Lysakerfjord may constitute a biochemical response to the effects of organic enrichment in this area. In G. alba from the sampling station at Slemmestad, it is suggested that low phosphofructokinase and malate dehydrogenase activities may reflect a biochemical response to effects of predominantly inorganic waste material from a nearby cement factory. In groups of G. alba from 5 sampling stations, i.e., excluding Slemmestad, mean phosphofructokinase activity is correlated with redox potential at 4 to 5 cm depth in the sediments. The results are discussed with reference to earlier biological studies and it is shown that low phosphofructokinase activities are found in the groups of G. alba from those areas where low diversity of macrobenthic fauna have been reported. It is concluded that the changes in phosphofructokinase activity may consistently reflect effects of environment changes that are characteristically associated with inputs of waste material. (Author's abstract)
W85-01896

IMPACT OF DOMESTIC SEWAGE POLLUTION ON ENZYMATIC ACTIVITIES OF TWO PLANKTONIC COPEPODS (ACARTIA CLAUSI AND CENTROPAGES TYPICUS) (IMPACT D'UNE POLLUTION D'ORIGINE URBAINE SUR LES ACTIVITES ENZYMATIQUES DE DEUX COPEPODES PLANCTONIQUES (ACARTIA CLAUSI ET CENTROPAGES TYPICUS)),
Centre Univ. de Luminy, Marseille (France). Lab. d'Hydrobiologie Marine.
D. Riviere, and P. Kerambrun.
Marine Biology, Vol. 75, No. 23-35, p 25-35, 1983. 10 Fig, 4 Tab, 28 Ref.

Descriptors: *Copepods, *Enzymes, *Wastewater pollution, *Water pollution effects, Marseille, France, Municipal wastes, Effluents, Esterase, Aminopeptidase, Dehydrogenase.

The effect of urban pollution on the enzymatic activities of two copepod species, Acartia clausi and Centropages typicus, was studies in the Marseille area (main sewage output of Cortiou) from May 1980 through June 1981. By means of electrophoresis on polyacrylamide gel, activities of esterases, leucine aminopeptidase (LAP), malate dehydrogenase (MDH) and malic enzyme (ME) were studied. The results are based on 124 analyses of A. clausi and 127 of C. typicus. The zymograms revealed important changes in enzyme activities connected with pollution which were either qualitative or quantitative in nature; the most distinct and frequent changes were displayed by the esterases, whose general activity considerably decreased at the most polluted stations; also, the relative activity of the different esterase fractions changed, and certain fractions did not appear at all. Leucine aminopeptidase zymograms displayed little change; those of MDH and ME often exhibited an additional fraction in the polluted area. The results clearly show the impact of urban pollution at the enzymatic level. The changes appear to be a physiological response of the organisms to environmental conditions, and demonstrate the profound effects that an ecological perturbation can have on the physiology of organisms. (Author's abstract) W85-01898

EFFECTS OF COPPER AND CADMIUM ON GROWTH, SWIMMING AND PREDATOR AVOIDANCE IN EURYTEMORA AFFINIS (COPEPODA),

Rhode Island Univ., Kingston. Graduate School of Oceanography.
B. K. Sullivan, E. Buskey, D. C. Miller, and P. J. Ritacco.

Marine Biology, Vol. 77, No. 3, p 299-306, December, 1983. 7 Fig, 3 Tab, 32 Ref.

Descriptors: *Behavior, *Copper, *Cadmium, *Copepods, *Toxicity, Swimming, Predation, Immature growth stages, Heavy metals, Computers.

In the aquatic environment, pollutants typically occur at concentrations well below levels which directly cause death of organisms. The sensitivity of swimming behavior and predator-escape responses of nauplii of the estuarine copepod Eurytemora affinis to sublethal doses of Cu and Cd was studied in laboratory experiments. Average swimming speed of the nauplii were observed using computer analysis of video recordings. The responsiveness to mechanical stimuli designed to mimic a predator was tested. The importance of the modified behaviors to the outcome of actual encounters with predators was evaluated by measuring predation rates of one vertebrate and one invertebrate predator on nauplii. Behavior was generally altered at metal doses below those affecting growth rates or survival of the copepods. Swimming velocities of Cu-dosed nauplii were different from controls at all concentrations of Cu tested (10-50 micro g/l total Cu) after 24- to 48-h exposure; the development rate of nauplii was significantly reduced only after 96 h at 25 micro g/l. The 96 h LC50 for Cu was approximately 30 micro g/l Cu. Naupliar swimming velocity was also affected by Cd. Swimming speeds were reduced after 24 h at 130 micro g/l, the development was slowed after 48 h at 116 micro g Cd/l. The 96-h LC50 was > 120 micro g/l. Nauplii exposed to Cu for 24 h were generally hyperactive, a condition which could increase their encounter frequency with predators. Reduced numbers of escape responses of nauplii to a simulated predator were observed only after 48-h exposure to Cu. Feeding rates of non-dosed larval striped bass on dosed nauplii (24 h at 25 micro g Cu/l) were significantly higher than on control nauplii. Feeding rates of larval mysid shrimp were not higher on similarly dosed nauplii; 24 h exposure of nauplii to > 30 micro g Cu/l did result in increased predation by mysids. (Moore-IVI)
W85-01900

LOGGING IMPACTS AND SOME MECHANISMS THAT DETERMINE THE SIZE OF SPRING AND SUMMER POPULATIONS OF COHO SALMON FRY (ONCORHYNCHUS KISUTCH) IN CARNATION CREEK, BRITISH COLUMBIA,

Department of Fisheries and Oceans, Nanaimo (British Columbia). Pacific Biological Station.
J. C. Scrivener, and B. C. Andersen.

Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 7, p 1097-1105, 1984. 7 Fig, 2 Tab, 33 Ref.

Descriptors: *Salmon, *Logging, *Environmental effects, *Fry, *Carnation Creek, *British Columbia, Water temperature, Freshets, Fish behavior, Debris, Growth, Fish migration.

Natural patterns in emergence times, seaward movements, instream distributions, densities, and growth of coho salmon fry (Oncorhynchus kisutch) between March and September are contrasted with patterns observed during and after logging in the Carnation Creek watershed. After streamside logging in 1976-77, fry emerged up to 6 wk earlier and moved seaward more quickly than during years before logging. These observations are attributed to higher water temperatures during the winter and to emergence during a period of more frequent freshets. Increased fry movement from the stream could result in habitat being underutilized. In sections affected by intense streamside logging, the deposition of 'fine' logging debris led to increased fry densities during the summers of 1977 and 1978. After major freshets in November 1978, which removed this fine debris and affected channel morphology in these sections, fry densities declined below those observed prior to logging. Growth rate of fry was inversely correlated with density in all stream sections. Growth rates, after correction for density, tended to be greater in all sections after the adjacent streamside was logged. Larger fry and more variable numbers of fry remained in the stream in September after logging than before logging. Their increased size is attributed to the longer growing season afforded by earlier emergence. This complex of interacting factors determines the number and size of fry in autumn and it can influence the production of smolts the following spring. (Author's abstract) W85-01919

TOXICITY OF ORGANIC MIXTURES SATURATED IN WATER TO DAPHNIA MAGNA. EFFECT OF COMPOSITIONAL CHANGES,

Syracuse Research Corp., NY. Life and Environmental Sciences Div.
R. H. Sugatt, D. P. O'Grady, and S. Banerjee.

Chemosphere, Vol. 13, No. 1, p 11-18, 1984. 4 Tab, 10 Ref. EPA Grant R8 086 13.

Descriptors: *Toxicity, *Solutions, *Organic compounds, *Daphnia, Water pollution effects.

The toxicity of aqueous solutions saturated with mixtures of hydrophobic organic liquids is contrasted to that of solutions prepared from solids. Data for a variety of mixtures are presented and are related to the solubilities of the components. The toxicities of compounds in liquid mixtures are influenced by the composition of the mixtures, whereas those of solids are relatively independent of composition. If biological interactions are neglected, then the toxicity of a component in a saturated liquid mixture will tend to be lowered by the presence of other less toxic components, and the toxicity of a saturated solution of the mixture will equal or be less than that of the corresponding solution of its most toxic component. In contrast, the toxicity of a saturated solution derived from a mixture of solids will tend to equal or exceed that of a corresponding saturated solution of its most toxic component, and will tend to increase with the complexity of the mixture. These conclusions are broad generalities, incorporating numerous assumptions and should be used with caution. Nevertheless, they do illustrate the utility of simple physicochemical relationships in environmental hazard assessment. (Baker-IVI)
W85-01953

ANALYSIS OF AQUATIC TOXICITY DATA: WATER SOLUBILITY AND ACUTE LC50 FISH DATA,

W. B. Neely.

Chemosphere, Vol. 13, No. 7, p 813-819, 1984. 1 Fig, 2 Tab, 15 Ref.

Descriptors: *Organic compounds, *Solubility, *Fish, *Toxicity, Water pollution effects.

A theoretical relation has been established between the water solubility of an organic chemical and the ratio of the acute fish LC50 at two different time periods. The theory was tested by examining a data base of 24 chemicals. The finding of a positive correlation between the observed and calculated ratio of the 96 hr LC50 to the 24 hr LC50 helped to substantiate the theory. In addition to indicating a procedure for reducing LC50 values to a common time interval, the study has identified two groups of chemicals. If a chemical is soluble to the extent of 100 micrograms/L or less and possesses a low toxicity, then 96 hrs will not be long enough to accumulate a toxic dose. Examples are the chlorinated biphenyls, where the earliest time to achieve a 50% kill has been shown to be 12 days. Spillage of such a chemical would be no immediate concern from an acute point of view, as the spill will disperse much faster than the chemical can accumulate in the organism, causing the critical concentration to never be reached. The second group are the more soluble materials, which would have a high probability of accumulating in the organism in a very short period of time. If the agent was sufficiently toxic then a partial kill might result from a spill. Such categorization allows an investigator to make some early decisions on the potential problems resulting from the release of a chemical into an aquatic environment. (Baker-IVI)
W85-01966

LONGTERM EFFECTS OF THE HERBICIDES ATRAZINE AND DICHLOBENIL UPON THE PHYTOPLANKTON DENSITY AND PHYSICOCHEMICAL CONDITIONS IN COMPARTMENTS OF A FRESHWATER POND,

Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.).
J. P. Lay, A. Muller, L. Peichl, W. Klein, and F. Korte.

Chemosphere, Vol. 13, No. 7, p 821-832, 1984. 10 Fig, 1 Tab, 22 Ref. Commission of the European Communities contract ENVD-572-D (B).

Descriptors: *Herbicides, *Water pollution effects, *Phytoplankton, Population dynamics, Atrazine, Dichlobenil, Physicochemical properties.

The effects of two herbicides on the phytoplankton community and on physicochemical conditions of the water under outdoor conditions were studied. Atrazine and dichlobenil were dosed in triplicate into the water of a compartmentalized pond. Maximum concentrations of the chemicals detected were 200 micro g/l atrazine and 4.2 mg/l DBN on days 3 to 5 after dosing. Residues were monitored for 55 days, amounting to 60 microg Atrazine and 1.5 mg DBN per liter at the end of the study. Oxygen and hydrogen ion concentrations were significantly lower for 35 and 30 days, respectively, in treated as compared to control water. The conductivity of the dosed water was significantly higher for at least 65 (DBN) and 120 days (Atrazine) than in the untreated compartments. Differences in phytoplankton abundance and diversity could be evaluated between controls and treated biotypes. (Baker-IVI)
W85-01967

COMPARISON OF THE CARCINOGENIC RISKS FROM FISH VS. GROUNDWATER CONTAMINATION BY ORGANIC COMPOUNDS,

Harvard School of Public Health, Boston, MA. Interdisciplinary Programs in Health.
M. S. Conner.

Environmental Science and Technology, Vol. 18, No. 8, August, 1984. 1 Fig, 1 Tab, 34 Ref. EPA grant CR-807809.

Descriptors: *Carcinogens, *Risks, *Fish, *Groundwater pollution, *Organic compounds, Water pollution effects, Public health, Drinking water.

Water pollution can affect the general public's intake of organic carcinogens through two major pathways: drinking contaminated groundwater and consuming fish from contaminated surface waters. EPA's carcinogenesis risk assessment methodology is used to compare the risks from trace organic contaminants in groundwater to those in freshwater and marine fishes. Carcinogenic risks from consuming freshwater fish are several time greater than for most marine fish. In general, freshwater and estuarine fish from industrialized regions present similar orders of magnitude of risk, about 10 times greater than less-developed estuaries and 50-100 times greater than offshore fisheries. Lipophilic, biologically refractory organics are most often found in fish and soluble, volatile compounds in groundwater. Nationwide, known carcinogenic risks from fish consumption are at least as important as those from groundwater consumption, but both vary widely with location and consumption patterns. The risks reported range between a lifetime risk of cancer of 10 to the -4 to 10 to the -6. (Moore-IVI)
W85-02110

EFFECTS OF ACIDIFICATION ON THE ECOLOGY OF STREAMS IN THE UPPER TYWI CATCHMENT IN WEST WALES,
Welsh Water Authority, Powys (Wales).
J. H. Stoner.
Environmental Pollution, Vol. 84, p 125-157, 1984. 5 Fig, 6 Tab, 55 Ref.

Descriptors: *Acidification, *Water pollution effects, *Tiwi, *Wales, Sulfates, *Acid rain, Atmospheric deposition, Aluminum, Hardness, Land use, Vegetation, Stream pollution, Trout, Invertebrates.

Water quality data for three rainwater sites and thirteen streams were collected during the period February 1981-January 1983. Although rainfall in the upper Tywi is, on average, amongst the least acidic in the United Kingdom, episodic depositions of acidity do occur. 'Excess' sulfate concentrations in streams were elevated in comparison with those in rainfall, possibly as a result of the collection of 'dry' and 'occult' deposition by vegetation, evapotranspiration and the oxidation of sulfur in drained soils. Stream acidity and aluminium concentrations were, therefore, determined by the combination of stream buffering capacity and vegetation within the catchment. Consequently, the study streams could be classified on the basis of water hardness and land use. Stream surveys and survival studies using caged fish showed that unafforested streams with an average hardness of >8 mg/l can support trout populations and a reasonably diverse invertebrate fauna. Unafforested streams with mean hardness of <8 mg/l can support only sparse fish populations and limited invertebrate diversity. Afforested streams with an average hardness of <10 mg/l are incapable of supporting trout and the invertebrate fauna is very restricted. It is likely that areas with similar soils and geology, receiving similar deposition, can be classified on this basis and water quality data used to predict the fishery and invertebrate status of streams and the likely effects of changed land use. (Author's abstract)
W85-02116

LABORATORY ASSESSMENT OF THE TOXICITY OF URBAN RUNOFF ON THE FATHEAD MINNOW (PIMEPHALES PROMELAS),
Massachusetts Univ., Amherst. Dept. of Environmental Sciences.
C. Medeiros, R. A. Coler, and E. J. Calabrese.
Journal of Environmental Science and Health, Vol. A19, No. 7, p 847-861, 1984. 2 Fig, 3 Tab, 18 Ref. Dept. of Interior project 126-MASS.

Descriptors: *Urban runoff, *Fathead minnows, *Toxicity, Growth, Hatching, Survival, Water pollution effects, Snowmelt, Seasonal variation.

The early life stage effects of urban runoff (rain and snowmelt) on hatching, growth and survival of the fathead minnow (Pimephales promelas) was assessed in static and flow-through systems. The data indicate a Maximum Allowable Toxicant Concentration (MATC) and a reduction of growth to 50% of controls at 28% and 60% runoff, respectively. Hatchability and average lengths were not as sensitive indicators of stress as millimeters produced per treatment. The data indicate a maximum toxicity in the fall which coincided with the reported drop in macroinvertebrate diversity during the same period, when untreated runoff events can contribute up to 1/4 of the river flow. (Author's abstract)
W85-02124

5D. Waste Treatment Processes

COMPUTER CONTROLLED OPERATION OF AN ACTIVATED SLUDGE PLANT,
Milwaukee Metropolitan Sewerage District, WI. Treatment Services Div.
J. R. Grinker, and R. F. Meagher.
Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 823-829, July, 1984. 11 Fig, 4 Ref.

Descriptors: *Computers, *Automation, *Activated sludge process, Wastewater treatment facilities, Wastewater treatment, Process control, Effluents, Maintenance, Wisconsin.

Use of a computer to improve final effluent quality directly and indirectly through better control of the treatment process at the South Shore Wastewater Treatment Plant of the Milwaukee Metropolitan Sewerage District is described. The South Shore Plant is a conventional activated sludge plant consisting of bar screens, grit chambers, primary clarifiers, aeration basins, final clarifiers and chlorination facilities for disinfection. Methane gas from the digestion process is collected and used as fuel for electrical generation, process air blower engines, incineration and boilers, which provide over $1 million in energy savings per year. The value of automation was demonstrated by benefits in each of the control loops. These general advantages of computer control include reduced operator interface, more stable process control trains, reduced chemical and energy requirements, and improved final effluent quality. To make the entire concept work effectively it is essential to begin with pre-qualified field sensor selection when possible, develop simple control logic based on tested process control techniques and loops with sufficient fail-safe devices for backup, hire or train personnel with strong technical capabilities, establish a sound instrumental maintenance program, and have a commitment to stick with the fine tuning and debugging of each loop when its successful operation predicts sufficient benefits. Each treatment plant should be evaluated individually for the types of control logic and instruments that can best be applied. Once a sound control scheme is established it can continue to work well as long as reliable instruments are used and backed up with a routine schedule of calibration and preventive maintenance. (Baker-IVI)
W85-01652

EFFECT OF LOW DISSOLVED OXYGEN CONCENTRATION ON EFFLUENT TURBIDITY,
Gold Kist, Inc., Atlanta, GA.
J. E. Starkey, and P. R. Karr.
Water Pollution Control Federation Journal, Vol. 56, No. 7, p 837-843, July, 1984. 5 Fig, 3 Tab, 14 Ref.

Descriptors: *Dissolved oxygen, *Turbidity, *Effluents, *Wastewater treatment, Activated sludge process, Aeration, Atlanta, Georgia, Biochemical oxygen demand.

Turbid effluents have been observed at full-scale activated sludge plants operated with low dissolved oxygen (DO) concentrations in their aeration basins. An activated sludge plant in Atlanta, Ga. was operated with average DO concentrations of less than 1 mg/L in the aeration basins as a result of aeration equipment failure. During this period, plant effluent was turbid regardless of changes in sludge age, aeration basin contacting pattern, amount of solids recycled from sludge handling facilities, and seasonal variations. Once the aeration equipment was repaired and the DO concentration increased to more than 2 or 3 mg/L, plant effluent cleared and effluent suspended solids concentration was reduced. This condition was reproduced in the laboratory with bench-scale reactors fed synthetic wastewater. Increased effluent turbidity at low DO concentrations was the result of inhibition of exocellular polymer production and a reduction in the number of eucaryotic microorganisms. For a food to microorganism (F/M) ratio of 0.3 mg biochemical oxygen demand (BOD sub 5)/day/mg mixed liquor volatile suspended sludge (MLVSS), polymer production seemed to be responsible for approximately two-thirds and eucaryote activity for one-third of the changes in effluent turbidiy. Substantial increases in filtrate BOD sub 5 concentrations occurred when the DO concentration was lowered. This effect was greater at higher organic loading rates. The magnitude of change in suspended solids and BOD sub 5 was such that full-scale plants could be forced out of compliance with discharge permits by operating with insufficient DO concentrations. (Collier-IVI)
W85-01653

ULTRAVIOLET DISINFECTION OF SECONDARY EFFLUENT,
Trojan Technologies, Inc., London (Ontario).
G. E. Whitby, G. Palmateer, W. G. Cook, J. Maarschalkerweerd, and D. Huber.
Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 844-850, July, 1984. 5 Fig, 9 Tab, 27 Ref.

Descriptors: *Wastewater treatment, *Disinfection, *Ultraviolet radiation, Bacteria, Chlorination, Economic aspects, Water quality control.

The operational aspects were assessed and efficiency monitored of a full scale UV device designed specifically for disinfecting wastewater. A description of the UV unit indicates that a modular system was designed to require little maintenance and remain versatile. The system consists of a series of modules comprised of four quartz sheath-enclosed UV lamps. Two sets of 10 modules for a total of 8 lamps are located in one effluent channel, Unit A; the second channel is 40 cm wider and contains 2 sets of 15 modules for a total of 120 lamps, Unit B. The average flows over the lamps of Units A and B are 0.03 cu m/s and 0.02 cu m/s, respectively. Pumps and related maintenance are obviated because it is a gravity flow system. All of the major components are modular to prevent a major shutdown if one component requires maintenance or repair. Results show that UV disinfection of treated wastewater is a viable alternative to chlorination if the UV unit is designed specifically for this purpose. UV irradiation of wastewater can reduce the bacterial concentrations to safe levels without introducing a toxicant to fish in the receiving waters. (Baker-IVI)
W85-01654

TWO-STAGE BIOLOGICAL FLUIDIZED BED TREATMENT OF COKE PLANT WASTEWATER FOR NITROGEN CONTROL,
Canviro Consultants Ltd., Kitchener (Ontario).
S. G. Nutt, H. Melcer, and J. H. Pries.
Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 851-857, July, 1984. 4 Fig, 6 Tab, 26 Ref.

Descriptors: *Steel industry, *Coke plants, *Industrial wastes, *Wastewater treatment, *Nitrogen, *Fluidized bed process, Fluidized beds, Denitrification, Nitrification, Cyanide, Thiocyanates, Phenols.

To assess the technical feasibility of treating coke plant wastewaters in a two stage fluidized bed system operated in the denitrification-nitrification mode, a pilot scale investigation of the process was conducted. The pilot scale system consisted of two fluidized bed reactors in series, coupled to provide carbon oxidation, nitrification, and denitrification in the pre-denitrification operating mode. The flu-

idized bed process was capable of achieving complete nitrification and denitrification of undiluted coke plant wastewater without the addition of powdered activated carbon to the system. Total nitrogen removal efficiencies in excess of 90% were maintained in the fluidized bed process at a total system HRT of about 16 hr. The process consistently attained in excess of 90% removal of organic carbon thiocyanate, and phenolic compounds despite step changes in loading conditions and periodic reductions in the efficiency of nitrification. The removal efficiency of total cyanide in the process depended on the fraction of cyanide which was biodegradeable. Operation of the coupled process in the pre-denitrification mode reduced the theoretical oxygen demand of the wastewater by about 66% because of the removal of a substantial fraction of the degradable organic carbon under anoxic conditions in the denitrification reactor. Oxygen requirements for complete nitrification were about 1.0 g oxygen/liter wastewater treated. Flow distribution was a critical factor in achieving high biomass concentrations in the nitrification reactor. (Baker-IVI)
W85-01655

RESTORATION OF FAILING ON-SITE WASTEWATER DISPOSAL SYSTEMS USING WATER CONSERVATION,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
W. E. Sharpe, C. A. Cole, and D. D. Fritton.
Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 858-866, July, 1984. 5 Fig, 9 Tab, 17 Ref.

Descriptors: *Water conservation, *Wastewater disposal, *On-site disposal, Soil properties, Soil absorption capacity, Water quality control, Public opinion, Clogging, Permeability, Septic tanks.

The wastewater reduction possible with water conservation hardware was documented under conditions of actual use along with changes in wastewater quality and homeowner acceptance of the devices. Maximum level water conservation devices consisting of air assisted toilets, front loading automatic washers, low flow shower heads and faucet flow control aerators successfully reduced the severity of septic tank-soil absorption system malfunctions. Water conservation devices producing lower levels of wasteflow reduction were not successful by themselves in correcting malfunctions, but in three cases where the most inexpensive water conservation hardware was used in conjunction with an alternate soil absorption system the malfunctions were completely eliminated. Malfunctions of septic tank-soil absorption systems appeared to be closely related to peak waste loadings, precipitation events, and local drainage characteristics. Effluent levels in the malfunctioning soil absorption areas fluctuated widely in response to loading, with surface discharge occurring under peak load. Water conservation devices reduced peak effluent loads to all systems. User acceptance of the water conservation devices was very good. Hydraulic load reduction with water conservation devices seems to be a viable method of alleviating failed septic tank soil absorption systems where the cause of failure is slowly permeable soil or organic clogging of soils with otherwise acceptable porosity. (Baker-IVI)
W85-01656

PILOT PLANT DEMONSTRATION OF BIOLOGICAL PHOSPHORUS REMOVAL,
Whitman, Requardt and Associates, Baltimore, MD.
C. W. Deakyne, M. A. Patel, and D. J. Krichten.
Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 867-873, July, 1984. 6 Fig, 3 Tab, 3 Ref.

Descriptors: *Wastewater treatment, *Phosphorus removal, *Activated sludge process, Industrial wastes, Metals, Phosphates, Biological wastewater treatment, Pilot plants.

The A/O process is a modified form of the activated sludge process that promotes the growth of certain microorganisms which absorb large amounts of phosphate while oxidizing the polluting components of the wastewater. The modification consists of the addition of a non-aerated zone upstream of the normal aerated tank. A conventional secondary clarifier with recycle sludge pumps completes the process. The A/O process provides for removal of phosphates from the wastewater via a biological process that incorporates the phosphates within waste activated sludge. The A/O plant produced an effluent with a phosphorus concentration within the NPDES discharge permit limit while simulating the full scale annual average flow of 3.07 cu m/sec with diurnal variations and all four reactor trains in operation. The plant met the effluent BOD5 and suspended solids NPDES permit requirements under both test modes. The sludge from the pilot plant exhibited good flocculating and settling characteristics with average sludge volume index values from 59 to 75 mL/g. The phosphorus is removed from the system via waste sludge with elevated phosphorus levels of about 5% P by weight. The A/O waste activated sludge releases phosphorus if allowed to become anaerobic, and addition of ferric chloride and lime precipitates the released phosphorus in as little as 5 minutes contact time. (Baker-IVI)
W85-01657

NONSTEADY-STATE-BIOFILM PROCESS FOR ADVANCED ORGANICS REMOVAL,
Newmark (Nathan M.) Consulting Engineering Services, Urbana, IL.
B. E. Rittmann, and C. W. Brunner.
Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 874-880, July, 1984. 9 Fig, 3 Tab, 12 Ref.

Descriptors: *Wastewater treatment, *Biofilms, *Model studies, Organic compounds, Galactose, Nitrification, Nitrates, Ammonia.

The long term capability of a nonsteady state biofilm to allow efficient removal of a trace level substrate was demonstrated. A mathematical model that predicts the transient growth, decay, and substrate utilization of a nonsteady state biofilm was developed and evaluated while the role of nitrification and bacterial adaptation in reducing the rate of heterotrophic biofilm decay under nonsteady state conditions was investigated. The nonsteady state biofilm process was able to sustain good (>85%) removal of trace level substrate for 1 year without reactivation. Although background organic material in the feed medium contributed to reducing the biofilm loss rate, the slow loss of biofilm activity was explained primarily by organic supplementation from nitrification and bacterial adaptation to oligotrophic conditions. The transient biofilm model included growth of loss of biofilm thickness during nonsteady state operation. The model was reasonably successful at predicting biofilm growth and approach to steady state when all input parameters were determined independently. Because of the complications with nitrification, adaptation, and background organics, the model could not be satisfactorily evaluated during the loss phase. The slow decay of the nonsteady state biofilm suggests that the nonsteady state process should be able to achieve advanced organics removal for extended periods of time without requiring sophisticated operating procedures. (Baker-IVI)
W85-01658

MIXING EFFECTS IN UV DISINFECTION,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
B. F. Severin, M. T. Suidan, and R. S. Engelbrecht.
Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 881-888, July, 1984. 12 Fig, 10 Ref.

Descriptors: *Ultraviolet radiation, *Wastewater facilities, *Design criteria, *Disinfection, Wastewater treatment, Kinetics, Mixing, Destratification, Chemical reactions.

The design of UV reactors for the disinfection of wastewater effluents presents a unique set of problems: complex inactivation kinetics, rapid reactions, and complex and nonuniform UV intensity profiles within the reactor. Methods are presented for quantifying mixing effects in single-lamp, annular reactors with nonuniform UV intensity fields through the use of series event inactivation kinetics. An event is assumed to be the total damage incurred in a level of UV exposure. Events occur in a stepwise fashion and each step is considered as an integer function. The rate at which an organism passes from one event level to the next is first order with respect to UV intensity and is independent of the event level occupied by the organism. Batch UV inactivation data were collected in a completely mixed, thin-layer reactor using water with high UV transmission. Having developed the fundamental concepts of limiting mixing conditions on reactor efficiency for annular single lamp reactors from series event inactivation kinetics, it was determined that mixing in the radial direction is extremely beneficial while mixing in the longitudinal direction is detrimental to reactor efficiency. In general, it is probably beneficial to allow mixing in the longitudinal direction in order to ensure that radial stratification does not occur. These individual concepts of limiting mixing conditions can be combined to qualitatively describe the efficiency of a simple reactor system. (Baker-IVI)
W85-01659

AEROBIC SLUDGE DIGESTION WITH PH CONTROL - PRELIMINARY INVESTIGATION,
British Columbia Univ., Vancouver. Dept. of Civil Engineering.
B. C. Anderson, and D. S. Mavinic.
Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 889-897, 7 Fig, 6 Tab, 12 Ref.

Descriptors: *Activated sludge process, *Aerobic digestion, *Hydrogen ion concentration, Wastewater treatment, Industrial wastes, Municipal wastes, Biological wastewater treatment, Lime.

The behavior of a waste activated sludge undergoing aerobic digestion was examined when the pH of the digesting mass was raised above that found in normal operation. The first phase of the research used clarifier underflow sludge from a pilot scale, wastewater treatment trailer for nutrient removal research. In the second phase the waste sludge came from the clarifier underflow of a conventional, full-scale, activated sludge plant. At 20 degrees C there was considerable improvement in the efficiency of the digestion process at pHs higher than those usually associated with the field digestion of waste sludge. Depending on the digester pH, the solids retention time and the type of sludge used, VSS destruction efficiencies of almost 54% were obtained. The lime doses needed to attain these performances were considered minimal. Digester performance was decreased at 12 C and 5 C, mainly because of the biological nature of the process and the temperature responses of the microorganisms. In most cases the conventional sludge outperformed the modified Bardenpho sludge in terms of digestion efficiency in the unbuffered reactors. The modified-Bardenpho sludge responded much better to liming and achieved digestion efficiencies much greater than the conventional sludge at higher pHs. The overall effect of liming at any of the temperatures was to increase the efficiency of the digestion process to the extent that various sets of operating parameters could be chosen to achieve a given VSS reduction. A cost benefit analysis was used to identify possible areas of cost savings from lime pH control. (Baker-IVI)
W85-01660

CONVENTIONAL WATER PROCESS COSTS STUDIED,
Texas Univ. at El Paso. Dept. of Civil Engineering.
A. Tarquin, and S. Goodwin.
Water Engineering and Management, Vol. 131, No. 7, p 24-27, July, 1984. 2 Fig, 3 Tab, 10 Ref.

Descriptors: *Wastewater treatment, *Sludge, *Aeration, *Economic aspects, *El Paso, *Texas, Cost-benefit analysis, Hardness, Turbidity, Water properties.

A study is presented of aeration and sludge recirculation processes at an El Paso, Texas water plant. Of 13 parameters measured, only those related to hardness and turbidity were affected by secondary sludge recirculation and aeration. Aeration without sludge recirculation did not improve the performance of the primary clarifier with respect to any of the raw water parameters measured. Recirculation of secondary sludge ahead of the primary clarifier effected hardness reduction with significant savings in the cost of lime. Although the largest hardness and turbidity reductions through the clarifier occurred when both sludge recirculation and aeration were practiced, the most cost-effectve operating procedure occurred during sludge recirculation only. The commonly applied water treatment practices of sludge recirculation and aeration can significantly affect the removal of some compounds in the primary clarifier. The large increases in energy costs which have occurred over recent years warranted renewed investigations of a case by case basis of the cost effectiveness of such practices. (Baker-IVI)
W85-01706

HYDRODYNAMIC OF CIRCULAR PRIMARY CLARIFIERS,
Windsor Univ. (Ontario). Dept. of Civil Engineering.
S. M. Abdel-Gawad, and J. A. McCorquodale.
Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 299-307, June, 1984. 11 Fig, 30 Ref.

Descriptors: *Clarifiers, *Hydrodynamics, Mathematical equations, Simulation, Velocity, Dispersion, Settling tanks, Water treatment, Wastewater treatment, Prediction, Strip integral method.

The strip integral method has been applied to a typical restricted inlet circular primary clarifier, in order to simulate the flow pattern and dispersion characteristics of the flow. This method assumes a dominant flow direction and with the use of velocity shape functions reduces the equations of motion and continuity to a set of simultaneous ordinary equations. Three shapes were chosen, corresponding to the boundary layer, the potential core, and the free mixing and recirculation zone. A Runge-Kutta method was used to integrate the set of ordinary differential equations. A standard finite element method was used in the withdrawal zone. The numerical predictions compared favorably with experimental velocity distributions obtained in a physical mode of circular sedimentation tanks. The model is restricted to circular clarifiers of discrete suspension with low concentration operating at neutral density environment. The model was used to predict the velocity and dispersion characteristics of the circular tanks used at the West Windsor Pollution Control Plant, Windsor, Ontario. (Author's abstract)
W85-01716

ADSORPTION OF COPPER, LEAD AND COBALT BY ACTIVATED CARBON,
Texas Univ. at Dallas, Richardson. Inst. for Environmental Sciences.
A. Netzer, and D. E. Hughes.
Water Research, Vol. 18, No. 8, p 927-933, 1984. 16 Fig, 1 Tab, 8 Ref.

Descriptors: *Copper, *Lead, *Cobalt, *Activated carbon, *Adsorption, Hydrogen ion concentration, Heavy metals, Metal removal.

The phenomena of lead, copper and cobalt adsorption by activated carbon from aqueous solution was studied in detail. Laboratory studies were conducted to evaluate and optimize the various process variables (i.e. carbon type, solution pH, equilibrium time and carbon dose). A quantitative determination of the adsorptive capacity of activated carbon to remove these metals was also determined. Significant differences were found in the ability of different types of activated carbons to adsorb lead, copper and cobalt from aqueous solution. Solution pH was found to be the most important parameter affecting the adsorption. It was found that there was practically no adsorption of lead, copper and cobalt by activated carbon below a well defined solution pH value for each metal. This critical solution pH value was found to be lower than the pH value associated with the formation of hydrolysis products. Of the ten commercially available activated carbons evaluated in these experiments, Barney Cheney NL 1266 was found to absorb the largest percentage of lead, copper and cobalt. The adsorption of any single metal (lead, copper and cobalt) was hindered by the presence of the other metals; the metals apparently competed for adsorption sites. (Author's abstract)
W85-01717

EFFECTS OF BAFFLES ON THE PERFORMANCE OF MODEL WASTE STABILIZATION PONDS,
Birmingham Univ. (England). Dept. of Civil Engineering.
J. S. Kilani, and J. A. Ogunrombi.
Water Research, Vol. 18, No. 8, p 941-944, 1984. 2 Fig, 2 Tab, 11 Ref.

Descriptors: *Stabilization ponds, *Baffles, Wastewater treatment, Hydraulic properties, Biochemical oxygen demand, Chemical oxygen demand, Dispersion, Flow pattern.

The hydraulic flow pattern in stabilization ponds is one of the major factors influencing pond performance. The performance of three baffled laboratory-scale facultative ponds were compared with that of an unbaffled control pond. The hydraulic characteristics of the ponds were estimated from the results of tracer tests. Biochemical oxygen demand (BOD5) removals achieved with the control pond and with the ponds having 3, 6 and 9 baffles were 79, 81, 86 and 89% respectively and chemical oxygen demand (COD) removals were 81, 84, 84.2 and 84.2%. The reductions in total solids (TS) were respectively 43, 46, 51 and 64%. The performance of laboratory scale facultative stabilization ponds was found to be considerably improved by decreasing the dispersion index of the pond flow pattern by using baffles. Dispersion indices of 0.161, 0.126, 0.112 and 0.096 were obtained for the control, 3, 6 and 9 baffle ponds respectively, which indicated a trend of decreasing dispersion index with increasing number of baffles. Near-plug-flow conditions were obtained and these are desirable for efficient operation of facultative ponds. (Moore-IVI)
W85-01719

INITIAL STUDIES ON THE USE OF HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY FOR THE RAPID ASSESSMENT OF SEWAGE TREATMENT EFFICIENCY,
L. Brown, M. M. Rhead, and J. Braven.
Water Research, Vol. 18, No. 8, p 955-961, 1984. 8 Fig, 14 Ref.

Descriptors: *High-performance liquid chromatography, *Wastewater treatment, Chromatography, Activated sludge process, Biological wastewater treatment, Efficiency, Biodegradation.

The difficulties inherent in getting real-time feedback information, suitable for in situ monitoring of biodegradation efficiency, has severely hampered the development of automatic biological treatment optimization and cost effective treatment. High-performance liquid chromatography (HPLC) techniques suitable for the rapid analysis of low-molecular weight polar dissolved organic compounds (PDOC) have been developed and applied to the full-scale field trial assessment of the efficiency of secondary sewage treatment at an activated sludge and percolating biological filter sewage works. The results obtained for the fate of specific polar low-molecular weight constituents are compared with concurrently obtained dissolved and total BOD5, COD, ammonium and total oxidized nitrogen data. HPLC techniques may offer an alternative to BOD5, COD analyses and give an insight into the fundamental removal processes occurring during primary and secondary sewage treatment. (Moore-IVI)
W85-01721

CONTACT FLOCCULATION-FILTRATION OF HUMIC SUBSTANCES,
Technion - Israel Inst. of Tech., Haifa. Environmental and Water Resources Engineering.
M. Rebhun, Z. Fuhrer, and A. Adin.
Water Research, Vol. 18, No. 8, p 963-970, 1984. 10 Fig, 4 Tab, 12 Ref.

Descriptors: *Humic substances, *Flocculation, *Filtration, Alum, Polymers, Minerals, Clarification, Wastewater treatment.

Contact coagulation filtration of humic substances gives early breakthroughs shortening the filtration cycles. Contact flocculation filtration of humic dispersions with alum in medium grain (0.62 mm) sand gave short runs to breakthrough, while in coarse (1.2 mm) media clarification was inefficient. Alum with cationic polymer gave in coarse media acceptable runs, but shorter then for mineral dispersions. Analysis of the breakthrough curves and of filtration parameters from different models indicates that initial filtration is rapid and efficient, but the resistance to detachment or disturbance forces is weak. The detachment or disturbance forces overtake with increase in specific deposit values and the low filtration capacity for humic-alumino flocs and corresponding low density of its accumulated deposit indicate a voluminous nature of the deposit. The solid content and the density of alumo-organic deposits in bed are much lower than of alumo-mineral deposits. Polymers and minerals increase the solid content, the density of deposits and the mass capacity of filter beds. (Moore-IVI)
W85-01722

MECHANISMS OF METAL ADSORPTION FROM AQUEOUS SOLUTIONS BY WASTE TYRE RUBBER,
Edinburgh Univ. (Scotland). Dept. of Chemistry.
A. G. Rowley, F. M. Husband, and A. B. Cunningham.
Water Research, Vol. 18, No. 8, p 981-984, 1984. 4 Tab, 10 Ref.

Descriptors: *Adsorption, *Tires, *Cadmium, *Lead, *Mercury, Sulfur, Zinc, Heavy metals, Carbon black, Rubber, Ion exchange, Wastewater treatment.

The idea that shredded tire rubber might serve as a suitable adsorbent for the removal of toxic metals from effluents is plausible, particularly considering that vulcanizates contain carbon black (about 30% w/w). Sulfur is also present in the form of thiol groups and polysulfide links which might provide sites for the sorption of metals such as mercury. The mechanisms of adsorption of cadmium(II), mercury(II) and lead(I) on to shredded rubber from old automobile tires were studied. Sorption of mercury (II) and cadmium(II) from aqueous solutions by vulcanized rubber occurs at least partially by an ion-exchange type mechanism involving displacement of zinc(II). There are at least two types of site from which zinc(II) can be displaced. The first type of site is available to cadmium(II) only, whereas the second type can be used by both cadmium(II) and mercury(II) but in a competitive situation mercury(II) is bound in preference. The sorption of lead(II) from aqueous solution by vulcanizates involves an entirely separate mechanism and site of adsorption as compared to mercury(II) and cadmium(II) sorption, and no zinc(II) displacement occurs. (Moore-IVI)
W85-01724

KINETICS AND PRODUCTS OF THE CHLORINATION OF CAFFEINE IN AQUEOUS SOLUTION,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 5B.
W85-01727

FATE OF TRACE ORGANICS DURING RAPID INFILTRATION OF PRIMARY WASTEWATER AT FORT DEVENS, MASSACHUSETTS,
National Center for Ground Water Research, Norman, OK.
S. R. Hutchins, M. B. Tomson, J. T. Wilson, and C. H. Ward.

Water Research, Vol. 18, No. 8, p 1025-1036, 1984. 9 Fig, 7 Tab, 38 Ref.

Descriptors: *Land disposal, *Organic compounds, *Rapid infiltration, *Fort Devens, *Massachusetts, Trace compounds, Groundwater pollution, Wastewater treatment, Infiltration.

Transport and fate of trace organics were studied during rapid infiltration of primary wastewater at a land application facility in Fort Devens, Massachusetts. A preliminary sampling trip was made to compare trace organic concentrations in the infiltrating wastewater and in ground water samples from three monitoring wells around the site. Trace organic concentrations were reduced by the rapid infiltration process. However, significant concentrations of specific compounds could be detected in ground water down-gradient of the site. Therefore, a field study was undertaken to determine the primary region where trace organics were removed in the system. Teflon monitoring wells were installed at a depth of 1.2-m in one of the basins at the site prior to flooding. Flooding was initiated and samples of the raw wastewater, the wastewater entering the basin, the infiltrate at 1.2-m depth and the ground water down-gradient of the site were analyzed for six compounds selected for the study. Results from replicate samples during the 6-day flooding period demonstrated that most of the removal for the six compounds occurred in the top meter of the soil, although concentrations of each compound increased substantially in the basin infiltrate from two of the sample points after the fourth day of flooding. No removal of p-dichlorobenzene, p-(1,1,3,3-tetramethylbutyl)phenol and 2-(methylthio)benzothiazole was apparent in the aquifer itself, as indicated by relatively high concentrations of these compounds in the contaminated monitoring well down-gradient of the site. These data indicate that trace organic concentrations in primary effluent can be reduced by rapid infiltration and that most of the removal occurs in the top meter of the soil during the early phase of the flooding cycle. This removal capability can rapidly diminish, however, and result in ground water contamination by trace organics above backgrounds levels. (Author's abstract)
W85-01730

MATERIAL BALANCE ANALYSIS FOR FLUORIDE IONS IN EXPERIMENTAL WASTE DISPOSAL PLANT,

NEC Environmental Engineering Ltd., Tokyo (Japan).
T. Iwasaki, K. Shirasuka, and S. Hayano.
Water Research, Vol. 18, No. 8, p 1053-1054, 1984. 1 Fig.

Descriptors: *Wastewater treatment, *Fluorides, *Alumina, Adsorbents, Waste disposal.

One problem which arose since the installation of an experimental waste disposal plant at the University of Tokyo has been the increase of the fluoride ion concentration in the discharged effluent over the standard value of 15 mg/liter. Countermeasures were taken by the trial use of activated alumina for adsorbent, and a study on the material balance of fluoride ions was carried out for the whole system. While the concentration of fluoride ions in the effluent can be effectively reduced below the legal level by the calcification-alumina adsorption combined process, there is still a problem to be solved in treating and removing the residual fluoride ions of 6.2 kg (10%) which is now released into the municipal sewer systems. (Baker-IVI)
W85-01732

WASTEWATER TREATMENT WITH AERATED SUBMERGED BIOLOGICAL FILTERS,

Montana State Univ., Bozeman. Inst. for Process Analysis
B. Rusten.
Journal of the Water Pollution Control Federation, Vol. 56, No. 5, p 424-431, May, 1984. 15 Fig, 3 Tab, 19 Ref.

Descriptors: *Wastewater treatment, *Aeration, *Municipal waste, *Filter media, Temperature effects, Sludge, Biological filters, Biological wastewater treatment.

Municipal wastewater was treated in two pilot-scale aerated submerged biological filters. Filter media with specific surfaces of 140 sq m/cu m and 230 sq m/cu m were tested. Design should be based on total organic surface load. The treatment efficiency decreased from 75% to 57%, measured as COD removal, when the organic load was increased from 5 g COD/sq m/day to 120 g COD/sq m/day. Volumetric removal rates were in excess of 10 kg COD/cu m in both filters. The organic load influenced the settling ability of the biological sludge. With the filters operating in a two-stage process at overflow rates of up to 0.9 cu m/sq m/hr the effluent suspended solids were below 10 mg/L. Improved settling may occur in full-scale settling basins. With the filters operating as single-stage reactors, specific sludge production was between 0.35 and 0.55 g TS/g COD removed. With the two stage process the sludge production increased from virtually zero at an organic removal rate of 3 g COD/sq m/day up to 0.40 g TS/g COD removed at a rate of 25 g COD/sq m/day. Oxygen transfer was good in both filters. Aerated submerged biological filters seem to be a good alternative to other biological treatment processes. The microorganisms grow on the media, eliminating sludge recycle and any disturbance resulting from sludge bulking. Trickling filters need a certain minimum hydraulic load to work efficiently. The strong turbulence also ensures good contact between substrate and microorganisms. An aerated submerged biological filter with a high surface area filter media is a simple and compact treatment process. (Baker-IVI)
W85-01736

METALS DISTRIBUTIONS IN ACTIVATED SLUDGE SYSTEMS,

Illinois Inst. of Tech., Chicago. Armour Coll. of Engineering.
J. W. Patterson, and P. S. Kodukula.
Journal of the Water Pollution Control Federation, Vol. 56, No. 5, p 432-441, May. 1984. 2 Fig, 12 Tab, 36 Ref.

Descriptors: *Metals, *Sludge, *Wastewater analysis, *Model studies, Distribution, Aluminum, Cadmium, Chromium, Copper, Iron, Lead, Nickel, Zinc.

Models are described which were developed to predict the distribution of metals in activated sludge system process streams. The study focused on eight metals: Al, Cd, Cr(III), Cu, Fe, Pb, Ni, and Zn. Composite samples of the dosed raw sewage, primary effluent, activated sludge mixed liquor, and secondary effluent were collected between 4 and 12 times during each run. The experiments indicated that a number of wastewater and process variables can affect metals distribution between the soluble and solids phases, but these findings are not easily extrapolated to continuous-flow systems receiving time-varying inputs of real wastewater. Based on extensive pilot plant data, empirical metals distribution models have been developed which are believed to be generally applicable. The models accurately predict the distribution of process stream metals between the soluble and solids phases. There is convincing evidence that solids-bound metals are disproportionately distributed between settleable and non-settleable solids in both raw wastewater and activated sludge mixed liquor. One model presented allows for that disproportionate distribution and accurately predicts metals removal across treatment train unit processes. (Baker-IVI)
W85-01737

RAPID BOD MEASUREMENT FOR MUNICIPAL WASTEWATER SAMPLES USING A BIOFILM ELECTRODE,

Washington Univ., Seattle. Coll. of Forest Resources.
S. E. Strand, and D. A. Carlson.
Journal of the Water Pollution Control Federation, Vol. 56, No. 5, p 464-467, May, 1984. 5 Fig, 9 Ref.

Descriptors: *Biofilms, *Biochemical oxygen demand, Wastewater treatment, Decomposing organic matter, Municipal wastewater.

The response of the biofilm BOD electrode was compared with the conventional 5-day BOD for samples of untreated, primary-settled, and secondary-treated municipal wastewaters. The biofilm BOD probe provided a signal within 20 minutes that was proportional to the conventional 5-day BOD for soluble organics in primary-settled municipal wastewater and secondary-treated municipal wastewater. The biofilm BOD probe did not respond to the particulate organic matter in untreated municipal wastewater. The precision of the biofilm BOD was comparable to the precision of the conventional 5-day BOD, and the BOD probe could be maintained in a stable condition for up to 3 weeks. (Baker-IVI)
W85-01739

IRRIGATION OF PUBLIC USE AREAS BY LAND APPLICATION OF COMBINED INDUSTRIAL AND DOMESTIC WASTE EFFLUENT,

Naval Facilities Engineering Command, Charleston, SC. Southern Div.
W. H. Sloan.
Journal of the Water Pollution Control Federation, Vol. 56, No. 5, p 474-481, May, 1984. 5 Fig, 4 Tab, 9 Ref.

Descriptors: *Wastewater irrigation, *Irrigation, *Land application, *Waste disposal, *Pensacola, *Florida, Wastewater treatment, Industrial wastes.

The wastewater treatment clinic plant at Naval Air Station Pensacola provides primary and secondary treatment for both the domestic and industrial wastes generated on the Station. Effluent is presently discharged into Pensacola Bay. A project is now under construction for irrigation of two golf courses with the combined effluent. The waste sources at the station are diverse and unusual, and the wastewater generated is complex and difficult to treat. Therefore, the waste treatment plant has an unusual design using separate modes of pretreatment for domestic and industrial influents and numerous ponds to dampen surges and provide significant flow retention and system stability. The typically limited water supply potential along the extreme Gulf coastal areas makes water supply a significant problems at the Station. The hydrogeologic character of the area makes the golf courses favorable sites for land treatment of effluent. The project will provide coincident benefits such as a reduction in potable water use and a decrease in irrigation costs. A better golf course turf will result due to increased availability of water, nitrogen and phosphorous in the effluent. A significant portion of the plant effluent, a potentially useful resource, will be reused when the project is completed. Although the surficial aquifer within the area is readily recharged by surface applied water, this system has been carefully designed in cooperation with state regulatory officials, and poses no threat to water supply sources. (Baker-IVI)
W85-01740

BLUE CRAB PROCESSING PLANT EFFLUENT TREATMENT,

Maryland Univ., College Park. Dept. of Agricultural Engineering.
F. W. Wheaton, R. B. Brinsfield, K. M. Lomax, and E. L. Geiger.
Journal of the Water Pollution Control Federation, Vol. 56, No. 5, p 482-486, May, 1984. 4 Fig, 6 Tab, 8 Ref.

Descriptors: *Food processing wastes, *Industrial wastes, *Wastewater treatment, Biochemical oxygen demand, Food processing industry, Coliforms, Biological wastewater treatment, Total suspended solids.

Effluent characterization studies showed that retort effluent had very high BOD5, in the range of 4,000 to 24,000 mg/L. Washdown water and effluent from hand sinks had much lower BOD5 concentrations, in the range of 146 to 710 mg/L. Total and fecal coliform counts were high enough

to require disinfecting to meet Maryland discharge guidelines. A 60-mesh screen significantly reduced total dissolved solids of effluent but had little effect on the BOD5, or volatile and nonvolatile solids concentrations in the effluent. An aerated biological treatment system was installed in a blue crab processing plant to treat plant wastewater. Retention time in the treatment system varied with the plant processing schedule, but averaged about 2 days. Water quality results indicate the pilot system will not provide sufficient treatment to meet the BAT (Best Available Technology Economically Achievable) discharge limitations for TSS and BOD5. (Baker-IVI)
W85-01741

ORGANIC AND INORGANIC MERCURY SPECIES IN THE FT. LEWIS SOLVENT REFINED COAL PILOT PLANT WATER TREATMENT PROCESS,
Washington State Univ., Pullman. Nuclear Radiation Center.
R. H. Filby, and B. W. Blomquist.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202480, Price codes: A04 in paper copy, A01 in microfiche. Water Research Center Completion Report, December 1983. 52 p, 9 Fig, 16 Tab, 31 Ref. Project No. OWRT A-114-WASH(1), Contract/Grant No. 14-34-0001-2151.

Descriptors: *Wastewater treatment, *Mercury, Coal conversion process, Liquefaction, Pilot plants, Washington, *Activated sludge process, Effluents.

The distribution of Hg in the water treatment process of the Ft. Lewis Solvent Refined Coal (SRC II) pilot plant was measured when the plant was operating in a production mode (50 tons coal per day). Mercury was found to concentrate in sulfide-rich process waters as the HgS2(2-) ion. In the treatment of organic-rich wastewaters, Hg precipitates on dilution as HgS and is also concentrated in the biosludge and clarifier sludge (Al(OH)3) of the process. A concentration of 2610 ng Hg/g (dry weight basis) was observed in the biosludge. Effluent waters from the treatment process contained 0.2 ng Hg/mL, compared to previously determined values of 2 to 5 ng Hg/mL. A 2.8L laboratory unit was constructed to model an operating activated sludge process. A synthetic coal liquefaction wastewater was formulated to contain 619 mg C/L, predominantly in the form of phenols. Mass balance studies of the behavior of HG in this system showed that efficient reduction of HG levels in the feedwater (100 ng Hg/mL) to approximately 4 ng Hg/mL was achieved. Approximately 31 percent of the Hg entering the system was volatilized, presumably as Hgo. The reaction appeared to be reduction of Hg (II) by the bacterial enzyme, mercury reductase since the volatilization was a function of biological activity. The 4 ng/mL levels of Hg in effluent waters was found to be 80 percent organic and 20 percent inorganic in nature. The organic species were not identified but are probably organic complexes of Hg (II) rather than organomercury species (e.g., (H3HgX)).
W85-01798

INVESTIGATION OF PHOTOCATALYTIC OXIDATION FOR WASTEWATER CLEANUP AND REUSE,
SumX Corp., Austin, TX.
D. W. DeBerry, A. Viehbeck, G. R. Peyton, and M. Karpinski.
Available from the National Technical Information Sevice, Springfield, VA 22161 as PB84-202548, Price codes: A07 in paper copy, A01 in microfiche. Water Reuse Report RU-83/12, Bureau of Reclamation, Washington, D.C., July 1983. 119 p, 16 Tab, 32 Fig, 82 Ref, 2 Append. Project No. OWRT C-10029-R(1453)(1), Contract/Grant No. 14-34-001-1453.

Descriptors: *Water reuse, Water treatment, Solar energy, *Wastewater treatment, Organic compounds, *Photocatalysis, *Oxidation, Titanium dioxide, *Reaction kinetics.

A treatment process was investigated for removal of low concentrations of organic compounds from wastewaters. The treatment process uses light energy as the driving force for the photocatalytic oxidation of dissolved organic species on suspended semiconductor powders. Based on the results of a previous study, TiO2 was the semiconductor used in this program, which was designed to further characterize the process with respect to operating parameters and scope of applicability. Detailed kinetic analyses for the removal of a variety of organic compounds are presented. Factors such as light intensity, amount of semiconductor added, irradiated surface to volume ratio, light intensity, and amount of ionic constituents in the water were also investigated. Actual wastewater samples were obtained from several sources and used for process testing. The degree of effectiveness of the process was found to depend in part on the type of organic molecule being treated. Polar substances and compounds containing nitrogen or sulfur groups were much more susceptible to treatment than unsubstituted aromatics, mineral oils, or saturated hydrocarbons. The relative removal rates were not in direct relationship to the corresponding reaction rates with hydroxyl radicals, indicating that more is involved than hydroxyl radical production at the semiconductor powder surface. The main limiting rate factor for the systems studied was the low quantum efficiency found, coupled with the wide band gap of TiO2 which allows use of only a small fraction of the solar spectrum.
W85-01813

DISPOSAL OF HOUSEHOLD WASTEWATER IN SOILS OF HIGH STONE CONTENT (1981-1983),
Arkansas Univ., Fayetteville. Water Resources Research Center.
E. M. Rutledge, C. R. Mote, D. T. Mitchell, M. S. Hirsch, and M. D. Harper.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-195809, Price codes: A09 in paper copy, A01 in microfiche. Water Resources Research Center Publication No. 103, December 1983. 183 p, 71 Fig, 20 Tab, 32 Ref, 1 Append. Project No. OWRT B-060-ARK(1), Contract/Grant No. 14-34-0001-1204.

Descriptors: Septic tank systems, *Filter fields, Soil adsorption systems, Septic tank treatment, Climatic stress periods, *Wastewater disposal fields, *Wastewater disposal, Wastewater treatment, Soil filtration, Ammonia, Nixa soils, Organic carbon, Nitrates, Nitrification.

Four experimental filter fields were constructed with built-in monitoring equipment in Nixa soils, containing chert fragments, and a fragipan (the design limiting feature) at 60 cm. The four were (1) a 'standard' field, 76 cm deep, in the pan; (2) a 'modified standard', 30 cm deep, above the pan; (3) a 'modified pressure' field, 40 cm deep, above the pan, with pressure distribution, and (4) a 'modified pressure' field, 6 cm below the soil surface. Placing filter fields higher in soil above the pan led to improved hydraulic performance. Approximately a 50% reduction of TOC occurred within all beds, with further reductions of 30% to 40% within 60 cm of the beds. Reductions in NH3 of 10% to 15% occurred within the beds of the 'standard', and 'modified standard' fields, with further reductions of 80% to 90% in the soil. There was a significant reduction in the total of NH3 and NO3 concentrations with distance from the beds.
W85-01815

RUNOFF FROM UTILITY WASTE LANDFILL TO BE RECYCLED FROM DETENTION BASIN TO SCRUBBER MAKE-UP,
Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
J. J. Lentz.
Industrial Water Engineering, Vol. 20, No. 1, p 8-17, January/February, 1983. 3 Fig, 5 Tab, 11 Ref. Maryland Power Plant Sitting Program Contract P1-81-03.

Descriptors: *Runoff, *Settling basins, *Waste disposal, *Vienna, *Maryland, Landfills, Fly ash, Sludge disposal, Powerplants, Heavy metals, Dissolved solids, Calcium, Sulfates.

Runoff from the working face of a proposed landfill for blended fly ash and scrubber sludge at a Vienna, Maryland powerplant will be captured in a lined retention basin and used for 7 to 10% of total scrubber make-up needs in order to prevent escape of heavy metals and high total dissolved solids, mostly calcium and sulfate ions, into the sensitive surface water and ground water of the Delmarva Peninsula. The effectiveness of a runoff detention basin was investigated using 30 years of daily temperature and precipitation data to simulate continuing operation of the basin and make-up system under a variety of assumptions and alternate operation rules. The number of potential overflows which might be calculated is most highly sensitive to the assumed runoff coefficient. The runoff coefficient will not be a constant, but will vary directly with the degree to which the surface becomes saturated during a precipitation event. The system is sensitive to the rate at which make-up is withdrawn. Although the number of overflows during 3- or 6-week shutdown periods showed increases, the quantities of runoff spilled remained small. While the number of spills varied greatly as a function of both runoff coefficient and withdrawal rate, with careful matching of facilities design and operation to expected demand, a basin designed to hold contaminated runoff for recycling represents a workable approach to the management of an otherwise serious waste disposal problem. (Baker-IVI)
W85-01849

STATE-OF-THE-ART OF THE ELECTRODIALYSIS REVERSAL (EDR) PROCESS,
W. E. Katz.
Industrial Water Engineering, Vol. 21, No. 1, p 12-20, Winter, 1984. 4 Fig, 3 Tab, 8 Ref.

Descriptors: *Electrodialysis, *Wastewater treatment, Membrane processes, Water treatment, Minerals, Water quality control.

The Electrodialysis Reversal Process (EDR) removes ionized salts and minerals from water and concentrates them in smaller volumes of water by means of direct current electricity. The DC electricity moves ions from a demineralizing or diluting compartment through selective ion exchange membranes into an adjoining concentrating compartment. This process is more tolerant than other commercially available membrane processes of a wide range of troublesome organic, inorganic, colloidal, and biological contaminants in water. The predominant use of EDT for much of the 1970s was the demineralization of brackish waters of several thousand parts per million total dissolved solids to potable levels of a few hundred parts per million for municipalities, oil and construction camps, hospitals, hotels, military bases, bottlers of beverages and purveyors of bottled water. By mid-1983, five public utility steam-electric generating stations with an aggregate capacity of 4000 MW had chosen EDR to pretreat boiler feed water prior to ion exchange demineralization. The basic principles for electrodialysis and EDR are defined and other applications of the method are given. (Baker-IVI)
W85-01851

REDUCTION OF COSTS AND LIABILITY RISKS IN ELECTROPLATING WASTEWATER TREATMENT,
A. C. Salas, and H. J. Cunha.
Industrial Water Engineering, Vol. 21, No. 2, p 9-13, Spring, 1984. 4 Fig, 5 Tab, 8 Ref.

Descriptors: *Wastewater treatment, *Electroplating, *Industrial wastes, Economic aspects, Electrodialysis, Reverse osmosis, Evaporation, Ion exchange, Waste recovery.

The Federal Water Pollution Control Act prohibits the discharge of pollutants into waterways from any point source, unless an appropriate permit has been issued. A summary of the Federal technology-based standards and their applicability is offered for the treatment of wastewaters from the electroplating industry. End of the line systems are used to clean the effluent streams just before discharg-

ing. These include steps to ensure the destruction of cyanides by oxidation with chlorine gas, sodium hypochlorite, hydrogen peroxide, or ozone; reduction of chromates by chemical or electrochemical means; combination of all metal bearing streams, adjustment of pH, and precipitation of metal hydroxides or sulfides; settling of suspended solids in a clarifier; thickening of the clarifier's sludge; and optional filtering of the clarifier's overflow, and discharge. Recovery systems are considered including evaporative concentration, reverse osmosis, electrodialysis, ion exchange, and electrolytic techniques. To establish a comparison between the various systems discussed with respect to cost and performance, a nickel plating operation was used an as example and costs and performance were estimated for each technology. While recovery systems are not the answer to all the water problems in electroplating operations, they should be the first ones to be considered in new installations and even as potential replacements for existing destructive systems. (Baker-IVI)
W85-01852

ANALYSIS OF QUANTITATIVE WASTEWATER MEASUREMENTS OF A COUNTRY RESTAURANT SITUATED AT APPROXIMATELY 1080 M ALTITUDE AND OF A MOUNTAIN INN SITUATED AT APPROXIMATELY 1410 M ALTITUDE (AUSWERTUNG VON SCHMUTZWASSER-MENGENMESSUNGEN BEI EINEM AUSFLUGSRESTAURANT, RUND 1080 M U. M. UND BEI EINEM BERGGASTHOF, RUND 1410 M U. M.),
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
H. Weber.
Wasser, Energie, Luft, Vol. 75, No. 3, p 37-42, 1983.

Descriptors: *Wastewater, *Restaurants, *Hotels, Wastewater treatment, Domestic wastes, Recreation.

The country restaurant (excursion restaurant) is on a throughfare and is the departure point for hiking and skiing trips. The restaurant seats 100, with 200 seats on the sun-terrace. The scenic mountain inn is for tourists and guests. Outside the 120 seat restaurant is room for 70 places, and the guesthouse has 30 beds. The wastewater of the two restaurants was measured quantitatively. The most important results obtained from the quantitative wastewater measurements are described and compared with previous data. With regard to the relative wastewater peaks, expressed in multiple daily means, the absolute peak values for 20, 60 and 120 minutes are plotted in liters per second. These wastewater handling levels determine treatment system parameters. (Moore-IVI)
W85-01854

YIELD AND QUALITY OF COTTON GROWN WITH WASTEWATER,
Arizona Univ., Tucson. Dept. of Plant Sciences.
A. D. Day, and J. A. McFadyen.
BioCycle, Vol. 25, No. 3, p 35-37, April, 1984. 3 Tab, 10 Ref.

Descriptors: *Water reuse, *Irrigation, *Crop yield, *Arizona, Water conservation, Cotton, Nutrients, Nitrogen, Salts, Phosphorus.

The effectiveness of municipal wastewater as a source of irrigation water and plant nutrients has been demonstrated in cotton production in Arizona. The crop was planted in April and harvested in November in each year. About 122 cm (48 inches) of irrigation water were required to produce a cotton crop. Two sources of irrigation water included pump water from local wells, and municipal wastewater and pump water in a 50:50 mixture. The pump water contained 4,600 ppm total soluble salts, 21 ppm nitrate nitrogen, 22 ppm total nitrogen, and 0 ppm elemental phosphorus. The wastewater and pump water mixture contained 3,400 ppm total soluble salts, 6 ppm nitrate nitrogen, 40 ppm total nitrogen, and 4 ppm elemental phosphorus. Fifty-six kg/ha of nitrogen fertilizer were applied prior to planting the cotton that was irrigated with pump water, increasing the total nitrogen to 334 kg/ha. Cotton grown with the mixture was taller, produced more seed cotton and lint cotton than cotton irrigated with only pump water. The wastewater when added to the pump water had no significant detrimental effects on most cotton fiber quality characteristics. (Baker-IVI)
W85-01869

CONSTRUCTION OF RATIONALIZATION EQUIPMENT AT THE ROSTOCK WATER-SUPPLY AND WASTEWATER-TREATMENT FACILITY (RATIONALISIERUNGSMITTEL-BAU IM VEB WASSERVERSORGUNG UND ABWASSERBEHANDLUNG ROSTOCK),
VEB Wasserversorgung und Abwasserbehandlung, Rostock (German, D.R.).
For primary bibliographic entry see Field 5F.
W85-01877

ENERGY STUDIES OF WASTEWATER-TREATMENT FACILITIES AS A BASIS FOR OPTIMAL ENERGY USE (ENERGIESTUDIEN VON ABWASSERBEHANDLINGSANLAGEN ALS GRUNDLAGE FUR DEN OPTIMALEN ENERGIEEINSATZ),
VEB Projektierung Wasserwirtschaft, Erfurt (German, D.R.).
H. Lopp.
Wasserwirtschaft-Wassertechnik, Vol. 34, No. 1, p 21-23, January, 1984. 1 Fig, 3 Tab, 5 Ref.

Descriptors: *Wastewater treatment facilities, *Energy, Gas production, Sludge treatment, Heat, Economic aspects, Pumps, Aerators.

The choice of means of energy supply for a wastewater-treatment facility (WTF) and of utilization of gas produced by the WTF demands in consideration of specific WTF conditions and the regional energy-supply structure. Criteria include economical effectiveness, longevity of machinery, feasibility of installation, and fullest possible energy supply of the WTF by self-produced gas and wastewater heat. Comparative energy-supply/gas-utilization studies should be preceded by efforts to optimize wastewater- and sludge-treatment processes and to reduce electrical and thermal energy requirements. Measures to reduce electricity demand include improvement of aeration equipment and correct adaptation of pumps to output. Heat requirements can be reduced by well constructed and insulated buildings and, in the case of sludge digestion plants, a better volume: surface ratio. Maximal gas production can be achieved through optimal design of the digestion tank with suitable sealing and insulation materials as well as intensification of the digestion process, including thickening of raw sludge, adequate circulation of digestion-tank contents, and maintenance of optimal tank temperature. The basis for effective gas utilization is its transformation into a usable form of energy, ensuring high energy level during transformation; coupling gas utilization with other energy-producing equipment, e.g., heat pumps with a high level of primary energy exploitation, and installation of the most economical energy carrier. Models for utilizing gas and supplying energy include gas boiler + coal boiler (to cover peak demand) + transformation of excess gas into fuel; gas boiler + coal boiler + selling excess gas; block thermal power station (BTPS) + gas boiler + coal boiler; BTPS + compression heat pump. (Gish-IVI)
W85-01878

DEVELOPMENT OF THE SCHWARZHEIDE CHEMICAL SYNTHESIS WORKS IN THE FIELD OF WASTEWATER AND BY-PRODUCT TREATMENT (ENTWICKLING DES VEB SYNTHESEWERK SCHWARZHEIDE AUF DEM GEBIET DER ABWASSER- UND ABPRODUKTBEHANDLUNG),
VEB Synthesewerke, Schwarzheide (German, D.R.).
R. Heepe.
Wasserwirtschaft-Wassertechnik, Vol. 34, No. 2, p 42-43, February, 1984. 1 Fig.

Descriptors: *Chemical industry, *Industrial wastewater, *Herbicides, Chemical wastes, Activated sludge treatment, Biological wastewater treatment, Costs, Cooling water, Recycling, Water conservation.

The Schwarzheide chemical works manufactures herbicides and polyurethanes (polyester-and polyester alcohols plus isocyanate) in the German Democratic Republic. It produces highly polluted wastewater as well as toxic solid and liquid by-products. At the works, by-products are incinerated. All wastewater is treated on-site by a two-stage activated sludge facility and nitrification, while wastewater with COD up to 30,000-100,000 mg/l goes through two preliminary steps (thermal purification, biological treatment) and that with COD 1,500-30,000 mg/l goes through the biological preliminary step. Elimination of 90-98% of COD, 5-day BOD, phenols, nitrate, ammonia, herbicides, and anline is achieved, but the annual cost of 45 million Marks has necessitated efforts to improve economic efficiency. Industrial and cooling water demand has dropped by about 30%, thereby reducing the wastewater volume and saving 1,000 man-hours/yr and 305,000 Marks/yr. Continuous measurement of ammonia and phosphate in wastewater has resulted in lower dosages of nitrogen and phosphorus for a 900,000 Marks/yr saving. Sludge resulting from wastewater treatment is no longer incinerated but used in the reclamation of mine dumps, saving over 3 million Marks worth of fuel oil. By-products of isocyanate manufacture are recycled, saving 11 million Marks/yr. Gas resulting from the production process has been substituted for fuel oil used in the incinerator, resulting in an annual reduction in oil consumption of more than 5,000 tonnes. (Gish-IVI)
W85-01881

IMPROVED OPERATIONAL CONTROL OF SEDIMENTATION FACILITIES THROUGH THE USE OF FIBEROPTIC SENSORS (VERBESSERTE BETRIEBSKONTROLLE VON SEDIMENTATIONSANLAGEN DURCH NUTZUNG FASEROPTISCHER SENSOREN),
VEB Zellstoff- und Papierfabrik, Rosenthal (German D.R.).
A. Geisenheiner, M. Wyrwich, and A. Hoffmann.
Wasserwirtschaft-Wassertechnik, Vol. 34, No. 2, p 43-45, February, 1984. 4 Fig, 8 Ref.

Descriptors: *Fiberoptics, *Sensors, *Particulates, *Sedimentation, Wastewater treatment, Industrial wastewater, Pulp wastes, Suspended solids.

A device was developed at the Rosenthal pulp and paper factory, Blankenstein, German Democratic Republic, to monitor the recirculator in its sedimentation facility, which is used in the treatment of industrial water. The device was needed to control suspended and settled particulates, which due to various factors in the sedimentation process often exceed the number permitted by law in wastewater treatment. A submersible probe was developed using photoconductive fibers; this can be called up to provide an underwater profile of particulate distribution. The probe consists of two sensor arms, one bearing a lamp and one bearing a phototransistor. In the measurement aperture between the two sensor arms, which is lit by the lamp, the flocs cause absorption impulses that are opto-electronically transformed by the phototransistor, then amplified and plotted. Fiberglass cables beam the light from the lamp to the measurement aperture and transmit the absorption impulse from the floc to the phototransistor. The light-beam diameter is determined by the most common floc size, while the absorption aperture is fixed according to maximum sensitivity of the phototransistor at a given light intensity. The probe was used for several months without problems to prove its reliability and usefulness. It could also be used in activation basins and in natural waters up to 100 m deep. (Gish-IVI)
W85-01882

FRIEDRICHRODA WASTEWATER TREATMENT FACILITY - RESULTS OF AN EXPERI-

MENT (KLARANLAGE FRIEDRICHRODA - ERGEBNISSE EINES EXPERIMENTS),
VEB Wasserversorgung und Abwasserbehandling, Erfurt (German, D.R.).
F.-W. Moller, H. Kuhles, and J. Hattenbach.
Wasserwirtschaft-Wassertechnik, Vol. 34, No. 3, p 58-64, April 1984. 11 Fig, 4 Ref.

Descriptors: *Wastewater treatment facilities, *Construction, *Friedrichroda, *East Germany, Costs, Centrifugal pumps, Pipes, Aeration, Sludge stabilization, Tanks, Optimization.

The new wastewater treatment plant (15,500 population equivalents, 160 cu m/hr dry-weather wastewater inflow) at the German Democratic Republic spa resort of Friedrichroda was constructed on the site of an old one, which continued to operate during the building process. The rake house with its vertical bar rake was built without a dump container or bridge crane (debris was discharged directly into a trailer and hauled away). Wastewater is driven into the two activation basins by means of two above-ground centrifugal sewage pumps, each with a series-connected intake container. Activation, tertiary-treatment, thickening, and sludge-stabilization tanks were built above ground to reduce costs by eliminating underground construction; the choice of wood as a construction material was not ideal. Constructing service bridges from steel was successful; design and corrosion prevention are especially important. The use of insulated open-air pipes with auxiliary electrical heaters was advantageous due to elimination of underground construction and good conditions for installation. Aeration of the two activation basins is achieved by an injector system. Optimization of the sludge stabilization process was achieved by experimentation. Costs were considerably reduced by the construction and treatment methods. (Gish-IVI)
W85-01884

WASTEWATER PURIFICATION AS RELATED TO THE STUDY OF A RIVER SYSTEM (ABWASSERREININGUNG IN VERBINDUNG MIT DER UNTERSUCHUNG EINES FLUSSSYSTEMS),
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
P. Paszto, and A. Horkai.
Wasserwirtschaft-Wassertechnik, Vol. 34, No. 3, p 67-69, April, 1984. 3 Fig, 4 Ref.

Descriptors: *Water pollution control, *Wastewater treatment, *Rivers, Water quality, Costs, Regulations, Standards, Planning, Computers.

Using the example of a river system (consisting of main river, tributary, and periodic stream emptying into the main river), it is demonstrated that water pollution and the demand for good-quality water can be treated as a spatial unit. This concept results in the elimination of unnecessary water facilities when compared with the traditional method of viewing users as individual units. In the planning stage, the complicated nature of the river system concept with the necessity of providing for compliance with standards and regulations throughout the entire system rather than for individual facilities requires computer technology. Examples of calculations for guaranteeing water-quality requirements and for various costs are given. (Gish-IVI)
W85-01885

COMPUTERIZED DISTRIBUTION RECORDS-CADD PAVES THE WAY,
Donohue and Associates, Inc., Waukesha, WI.
For primary bibliographic entry see Field 5F.
W85-01902

REDUCTION OF THE USE OF MATERIALS WITH THE AID OF SCIENCE AND TECHNOLOGY AT THE HYDROTECHNOLOGY AND WATER-MANAGEMENT-PLANNING COMBINE (SENKUNG DES PRODUKTIONSVERBRAUCHS MIT HILFE VON WISSENSCHAFT UND TECHNIK IM VEB KOMBINAT WASSERTECHNIK UN PROJEKTIERUNG WASSERWIRTSCHAFT),
VEB Projektierung Wasserwirtschaft, Halle (German D.R.).
K. Heilmann.
Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 45-46, February, 1983. 1 Ref.

Descriptors: *Wastewater treatment facilities, *East Germany, *Costs, Construction, Biological wastewater treatment, Pipes, Rakes, Blowers.

The German Democratic Republic Hydrotechnology and Water-Management Planning Combine (HTWMP) produces industry-specific equipment and rationalization devices to aid in the intensification of the water industry in compliance with government policy. One of the goals of rationalization is to reduce the amount of materials used in production while increasing production. An example of reduction in materials usage is a compact small-scale sludge-activation facility produced at the Merseburg wastewater treatment facilities to provide complete biological treatment of municipal wastewater. The compact facility corresponded to international standards with regard to performance, but the amount of material used in manufacture was too high. Cooperative study between workers, technology experts, and designers resulted in a 21% reduction in materials, especially in steel plate and pipe. Increased efficiency was achieved by means of a new type of blower, and this also reduced construction costs for the blower house by 30%. The central HTWMP has begun work to improve rake design; already 22% of material has been saved by redesigning the fork rake, and manufacture has been simplified. The next step will be the standardization of rakes, so that they will all be constructed according to the same principle. Reduction in materials usage can also be achieved by preventive maintenance to avoid repairs. (Gish-IVI)
W85-01968

INTENSIFICATION OF WASTEWATER AND SLUDGE TREATMENT PROCESSES THROUGH UTILIZATION OF THE ENERGY POTENTIAL OF WASTEWATER (INTENSIVIERUNG DER ABWASSER-UND SCHLAMMBEHANDLINGSPROZESSE DURCH NUTZUNG DES EIGENENERGIEPOTENITALS DER ABWASSER),
VEB Projektierung Wasserwirtschaft, Halle (German D.R.).
G. Voigtlander, and R. Zemlin.
Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 54-47, February, 1983. 2 Tab, 24 Ref.

Descriptors: *Wastewater treatment, *Energy recovery, Biological wastewater treatment, Sludge treatment, Biogas, Heat, Construction costs, Chemical treatment.

The energy crisis demands utilization of the energy potential of wastewater. This potential consists of wastewater heat and energy-rich organic matter. Heat in wastewater can arise from the industrial process producing the wastewater or from municipal wastewater, which can be 5 K warmer than drinking water. Biological gas from wastewater and sludge treatment has been transformed into mechanical or electrical energy with simultaneous utilization of waste heat at wastewater treatment facilities. A relatively new development has been the installation of heat pumps driven by biological gas, which use thermal energy from wastewater. Past efforts to optimize wastewater treatment have concentrated on biological processes occurring under natural environmental conditions. Future efforts should emphasize chemical treatment procedure with the specific goal of reducing construction costs. Intensification of the chemical procedure leads to reduced reactor volumes and thereby to a need for less equipment and lower construction costs. Raising temperatures to increase treatment speed is significant, especially in the case of highly concentrated wastewater and sludge. Anaerobic processes will become increasingly important due to their low energy consumption, as will the breeding of microorganisms for biological treatment at high temperatures. Tables are given for temperature-dependent wastewater and sludge chemical treatment methods for temperatures < or = to 353 K and = or > 353 K. (Gish-IVI)
W85-01970

SUGGESTION FOR YEAR-ROUND WASTEWATER UTILIZATION IN THE FORESTRY INDUSTRY (VORSCHLAG ZUR GANZJAHRIGEN ABWASSERVERWERTUNG IN DER FORSTWIRTSCHAFT),
M. Bahler, E. Drus, and R. Lutzke.
Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 60-62, February, 1983. 1 Fig, 1 Tab, 3 Ref.

Descriptors: *Frankfurt (Oder), *East Germany, *Land disposal, *Forestry, Wastewater disposal, Wastewater irrigation, Crop yield.

In order to eliminate the need to construct expensive tertiary wastewater treatment plants in the Frankfurt (Oder) region of the German Democratic Republic, preliminary studies were made for a pilot facility for the application of wastewater to forested land. This practice confers the same benefits as agricultural wastewater application (increased crop yield and wastewater purification through nutrient uptake by plants and filtering ability of soil) but unlike agricultural application can be continued throughout the entire year. The site chosen should be far from groundwater supplies with a permeable soil and should preferably be completely flat. Wastewater is applied via shallow furrows up to 200-m long, between which the trees are planted in rows. High wood yields are achieved with poplars and willows (25 cu m/hectare); this represents a three to four times higher yield than that produced from pine trees on the same, non-treated soil. Year-round application (75 mm every 2 wk; 1,800 mm total) resulted in the removal of 71.4% of total nitrogen (as measured in percolating water) and almost complete elimination of 5-day BOD and phosphates. Problems relating to health are significantly fewer with forest than with agricultural application, since forestry products are not used for human consumption. The preliminary studies resulted in the selection of two suitable forest areas for the pilot facility. (Gish-IVI)
W85-01971

ENZYMATIC HYDROLYSIS TESTS ON AN INDUSTRIAL EFFLUENT PRIOR TO ITS BIOLOGICAL PURIFICATION (ESSAIS D'HYDROLYSE ENZYMATIQUE D'UN EFFLUENT INDUSTRIEL AVANT SON EPURATION BIOLOGIQUE),
R. Mesnier.
Aqua, No. 6, p 471-476, 1982. 5 Fig, 3 Tab, 25 Ref.

Descriptors: *Industrial wastes, *Bulking sludge, *Wastewater treatment, *Enzymes, *Hydrolysis, Sludge, Bacteria, Biological treatment.

Studies were undertaken to determine the effect of retrograded boiled starch present in effluent to be treated on the bulking of sludge. When treating industrial effluent by biological means after enzymatic hydrolysis of the starch, the following points surfaced: enzymatic hydrolysis of the starch by amylase allowed the retrogradation of the boiled amylose to be avoided; this allowed the assimilation of the amylose and of the amylopectin by the purifying flora through the almost complete transformation of these compounds into simple sugars. This also limited the bulking phenomenon and rebalancing of the micro-fauna in the activated sludge. The development of filamentous bacteria was accompanied by an increase in the concentration of insoluble sugars (retrograded boiled starch) in the activated sludge. Application of this enzymatic hydrolysis technique was insufficient to bring about complete regression of bulking sludge in full expansion. Filamentous bulking of activated sludge depends both on a limiting substrate that is hard to assimilate and on the qualitative balance between the various nutrients necessary to the microorganisms to ensure the degradation of carbonaceous matter and purification of the wastewater. The pretreatment of substrates by enzymatic hydrolysis is not a sure-fire weapon in

dealing with bulking phenomena in general. (Baker-IVI)
W85-01975

STUDY CASES OF OPERATIVE CONDITIONS OF MUNICIPAL TREATMENT BY LAGOONING (ETUDE DES CONDITIONS DE FONCTIONNEMENT ET D'EXPLOITATION DE QUELQUES CAS CONCRETS DE TRAITEMENT D'EAUX RESIDUAIRES URBAINES PAR LAGUNAGE),
Societe Lyonnaise des Eaux et de l'Eclairage, Paris (France).
N. Dalga, G. M. Faup, and M. Ferry.
Aqua, No. 6, p 477-480, 1982. 7 Fig.

Descriptors: *Lagoons, *Municipal wastewater, *Aerated lagoons, Wastewater treatment, Biological oxygen demand, Chemical oxygen demand, Operating costs, Bacteria, Sludge lagoons.

In a study of 22 aerated lagoons and 9 natural lagoons in France, aerated lagoons were found to be under-sized compared to the generally accepted values; this is not usually the case with natural lagoons. Problems connected with the creation of lagoons were the seal of the reservoirs, dike stability, communications between reservoirs, and aerating devices. The main parameters taken into account for the purifying performance of lagoons were usual rejection parameters (MES-COD-BOD5) as well as the bacteriological charge. The results obtained were, generally, 90% on BOD5 and 75% on MES due to the presence of algae in the treated effluents. There was a reduction in the germ tests of 10 to the power of 4 or 6. The various maintenance operations were estimated in order to establish an operating cost. A first study of the energy consumption of aerated lagoons was carried out to establish a comparison with the usual methods. The major heavy operation in the running of lagoons concerns the extraction of sludge. The study made it possible to establish an average cleaning frequency while also finding a means of controlling silting. (Author's abstract)
W85-01976

BIOLOGICAL FOULING OF REVERSE OSMOSIS MEMBRANES,
Orange County Water District, Fountain Valley, CA.
D. G. Argo, and H. F. Ridgway.
Aqua, No. 6, p 477-480, 1982. 22 Fig, 8 Tab, 6 Ref.

Descriptors: *Membrane processes, *Reverse osmosis, *Wastewater treatment, Wastewater renovation, Detergents, Membranes, Enzymes, Chlorination.

During 28 months of operation, the Water Factory 21 experienced an overall flux decline rate of -0.159 gfd/month due to fouling in its wastewater demineralization plant, and a 40% decline in flow. The fouling layer was 90% organic and contained considerable quantities of carbohydrate, protein and adenosine triphosphate. A total bacterial count of about 7,500,000 cells/ml and a viable bacterial count of 10,000 cells/ml in the feedwater was noted. The fouling layer consisted primarily of bacteria attached to surfaces of the cellulose acetate membranes. The increase in bacterial numbers associated with the reverse osmosis membranes was inversely related to a progressive decline in membrane water flux. When the membranes were exposed to a free chlorine residual of 10 to 15 mg/l for a few days, they were rapidly destroyed. Evaluation of a number of different cleaning solutions indicated several were capable of removing the biofilm in laboratory experiments. The membranes receiving chlorinated feedwater appeared to clean better than those receiving nonchlorinated feed. All cleaners were less effective over time as the amount of biofilm on the membrane surfaces increased. The most effective solutions were combinations of detergents and enzymes. (Baker-IVI)
W85-01977

USE OF ARTIFICAL WETLANDS TO REMOVE NITROGEN COMPOUNDS FROM WASTEWATER,
Ecological Research Associates, Davis, CA.
R. M. Gersberg, C. R. Goldman, and B. V. Elkins.
Aqua, No. 6, 492-496, 1982. 4 Tab, 4 Ref.

Descriptors: *Wastewater treatment, *Nitrogen, *Nitrate, *Artificial wetlands, Wetlands, Bacteria, Biological treatment, Biological wastewater treatment.

The deleterious effects of nitrogen on both surface and groundwater supplies have led to a significant increase in research focused on the development of cost-effective and energy-efficient nitrogen removal process. Our investigations at Santee, California, have demonstrated the exceptional utility of artifical wetlands (800 sq m) for the removal of nitrate from nitrified secondary wastewaters at relatively high application rates. The major loss of nitrogen from these wetland systems was due to bacterial denitrification. When no carbon source was added to the marsh beds to supplement the carbon supply and fuel the denitrification process, nitrogen removal in the artifical wetlands was relatively low (8%). However, when the artifical marsh beds were amended with methanol, mean removal of TN (total nitrogen) was 94% at an application rate of 20 cm per day. Since artifical wetlands provide an ideal environment for photosynthetic carbon fixation as well as denitrification, we tested the efficacy of using plant biomass, mulched and applied to the surface of the artifical marsh beds, as an alternate and low-cost source of carbon. In mulch-amended beds the mean removal efficiencies were 70% for the TN and 77% for TIN (total inorganic nitrogen) at an application rate of 20 cm per day. Rising operational and energy costs make biological systems such as artificial wetlands very attractive as low-cost, low-energy systems for removal of nitrogen from municipal and agricultural wastewaters and contaminated groundwater supplies. (Author's abstract)
W85-01978

ULTRAVIOLET DISINFECTION OF WATER,
Katadyn Products, Inc., Wallisellen (Switzerland).
M. Angehrn.
Aqua, No. 2, p 109-115, 1984. 17 Fig, 5 Tab, 18 Ref.

Descriptors: *Ultraviolet radiation, *Water treatment, *Disinfection, Drinking water, Potable water, Water quality control, Bacteria, Microorganisms.

The first prototype unit for ultraviolet disinfection of water was built in 1910 in Marseille. The method was introduced into treatment of public water supplies in Switzerland in the 1950s. In Europe over 2000 communities now disinfect their drinking water with ultraviolet rays. Sufficient exposure and intensity inactivate irreversibly the DNA of microorganisms. Water quality and ageing of UV lamps in operation also have to be considered when dimensioning UV plants. Scientific tests using specific microorganisms and naturally contaminated water conclusively prove the safety of this method of disinfection. It is a cost-effective and valid alternative to chlorination and does not require the addition of chemicals to the water. (Baker-IVI)
W85-02020

CHLORINATION OF COOLING WATERS AND QUALITY OF WATER RESOURCES,
Antwerpse Waterwerken (Belgium).
W. Van Craenenbroeck.
Aqua, No. 3, p 165-169, 1984. 1 Fig, 23 Ref.

Descriptors: *Drinking water, *Chlorination, *Cooling towers, *Water quality control, Potable water, Microorganisms, Heat treatment, Powerplants, Industrial wastes.

Cooling waters from electric power plants are chlorinated in order to prevent bacterial slime formation in the condensor pipes, or mussel growth in the intake culverts. What effects this causes in the environment are considered along with possible alternative ways of treating the problem and thereby minimizing these environmental effects. Alternative antifouling treatments include the use of mechanical systems (such as rubber balls cleaning the condensor tubes to prevent microfouling caused by bacterial slime deposits), surface treatments, and heat treatments (by recycling warmed up cooling water). In many cases more chlorine has been added to treatment systems than was actually needed. (Baker-IVI)
W85-02023

MECHANISM OF SEMIFLUIDIZED BED BIOREACTOR FOR BIOLOGICAL PHENOL DEGRADATION,
Ohio State Univ., Columbus. Dept. of Chemical Engineering.
L. S. Fan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-207323, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Center Completion Report, 1983. 99 p, 34 Fig, 9 Tab, 63 Ref, 1 Append. Project No. OWRT A-060-OHIO(1).

Descriptors: *Wastewater treatment, *Mass transfer, *Biodegradation, Aeration, *Phenols, Kinetics, *Bioreactors, Bacteria, Organic wastes, Semifluidized bed reactor.

The kinetics of biological phenol degradation and the performance of the bacteria in a packed bed and semifluidized bed reactor were investigated in this research project. Batch studies at three temperatures, 24 degrees C, 35 degrees C, and 45 degrees C, were undertaken to determine the optimum operating temperature. Sewage bacteria acclimated to high phenol concentrations at each temperature were used in these studies. The bacteria were seeded onto various types of packing material for use in the semifluidized and packed bed studies. In the semifluidized bed, the flow of gas and liquid was countercurrent. From the semifluidized bed studies, a decrease in the liquid flow rate from 1500 ml/min to 100 ml/min increased the phenol degradation by approximately 10 percent. Investigation was also extended to cover the hydrodynamic behavior of the semifluidized bed. Separate experiments were conducted to study the hydrodynamic behavior of countercurrent flow of gas and liquid in a packed bed. A computational procedure was developed which allows a reasonably accurate prediction of the pressure drop in the semifluidized bed.
W85-02106

DEHALOGENATION OF THREE CHLORINATED HYDROCARBONS: AMINE-ASSISTED VERSUS METAL-CHELATE ASSISTED,
University of South Florida, Tampa. Chemical and Environmental Management Services Center.
For primary bibliographic entry see Field 5F.
W85-02121

EFFECT OF CHLORINATION ON ANTIBIOTIC RESISTANCE PROFILES OF SEWAGE-RELATED BACTERIA,
Ottawa Univ. (Ontario). Dept. of Biology.
G. E. Murray, R. S. Tobin, B. Junkins, and D. J. Kushner.
Applied and Environmental Microbiology, Vol. 48, No. 1, p 73-77, July, 1984. 1 Fig, 5 Tab, 25 Ref. Canadian Dept. of Supplies and Services contract ISU80-00323.

Descriptors: *Chlorination, *Antibiotic resistance, *Wastewater, Effluents, Bacteria, Wastewater treatment, Disinfection.

A total of 1,900 lactose-fermenting bacteria were isolated from raw sewage influent and chlorinated sewage effluent from a sewage treatment plant, as well as from chlorinated and neutralized dilute sewage, before and after a 24-h regrowth period in the laboratory. Of these isolates, 84% were resistant to one or more antibiotics. Chlorination of influent resulted in and increase in the proportion of bacteria resistant to ampicillin and cephalothin, the increase being most marked after regrowth occurred following chlorination. Of the other nine antibiotics tested, chlorination resulted in an increased proportion of bacteria resistant to some,

but a decrease in the proportion resistant to the remainder. Multiple resistance was found for up to nine antibiotics, especially in regrowth populations. Identification of about 5% of the isolates showed that the highest proportion of Escherichia coli fell in untreated sewage. Some rare and potentially pathogenic species were isolated from chlorinated and regrowth samples, including Yersinia enterocolitica, Yersinia pestis, Pasteurella multocida, and Hafnia alvei. The results indicate that chlorination, while initially lowering the total number of bacteria in sewage, may substantially increase the proportions of antibiotic-resistant, potentially pathogenic organisms. (Author's abstract)
W85-02139

5E. Ultimate Disposal Of Wastes

GEOHYDROLOGY OF THE MEADOWBROOK ARTIFICIAL-RECHARGE PROJECT SITE IN EAST MEADOW, NASSAU COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01774

MUNICIPAL SOLID-WASTE DISPOSAL AND GROUND-WATER QUALITY IN A COASTAL ENVIRONMENT, WEST-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. Fernandez, Jr.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4072, 1983. 29 p, 12 Fig, 2 Tab, 25 Ref.

Descriptors: *Landfills, *Water pollution sources, Water quality, Domestic waste, Coastal environment, *Florida, *Solid waste disposal, Groundwater pollution.

Solid waste is defined along with various methods of disposal and the hydrogeologic factors to be considered when locating land-fills is presented. Types of solid waste, composition, and sources are identified. Generation of municipal solid waste in Florida has been estimated at 4.5 pounds per day per person or about 7.8 million tons per year. Leachate is generated when precipitation and ground water percolate through the waste. Gases, mainly carbon dioxide and methane, are also produced. Leachate generally contains high concentrations of dissolved organic and inorganic matter. The two typical hydrogeologic conditions in west-central Florida are (1) permeable sand overlying clay and limestone and (2) permeable sand overlying limestone. These conditions are discussed in relation to leachate migration. Factors in landfill site selection are presented and discussed, followed by a discussion on monitoring landfills. Monitoring of landfills includes the drilling of test holes, measuring physical properties of the corings, installation of monitoring wells, and water-quality monitoring. (USGS)
W85-01789

WASTE MANAGEMENT SCENARIOS FOR MINNESOTA'S TWIN CITIES,
N. Goldstein.
BioCycle, Vol. 24, No. 1, p 17-20, January/February, 1983.

Descriptors: *Waste disposal, *Incineration, *Land disposal, *Minnesota, *Composting, Management, Planning, Twin Cities.

Various methods of dealing with wastes in Minnesota's Twin City area are discussed. Currently employed solutions include landspreading, incineration, and co-composting. The Metropolitan Waste Control Commission operates a regional sewage treatment plant, which generates 80% of the region's sludge. Land application for much of the sludge was used as an interim solution. While this interim solution has now become a successful operation, work on the incineration system is nearing completion using the Zimpro process. In this process the sludge is pressure cooked and heat from the initial batches is used to continue thermally treating the other sludge. During the winter all the sludge will be needed to run the incinerators, but during the summer, it may be possible to burn about 50% of the sludge and landspread and/or compost the remainder. Many neighborhoods also have waste management programs. The possible co-composting of both yard/leaf waste and regular garbage with sewage sludge is being studied. Another area of study has been the feasibility of a centralized processing pretreatment facility for platers in the Twin City area. This facility would be designed for small- to medium-sized metal finishers, electroplaters, and printed circuit manufacturing industries who can't afford to comply with discharge requirements on their own. (Baker-IVI)
W85-01867

HYDROGEOLOGY AND WATER QUALITY OF SIX LANDFILL SITES IN HILLSBOROUGH COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W85-01946

VOLATILE ORGANIC INPUTS FROM AN OCEAN OUTFALL NEAR BARCELONETA, PUERTO RICO,
Texas A and M Univ., College Station. Dept. of Oceanography.
M. C. Kennicutt, II, J. M. Brooks, and T. J. McDonald.
Chemosphere, Vol. 13, No. 4, p 535-548, 1984. 5 Fig, 5 Tab, 11 Ref. NOAA grants 04-8-MO1-55 and NA80RAD00039.

Descriptors: *Waste disposal, *Volatility, *Organic compounds, *Ocean dumping, *Barceloneta, *Puerto Rico, Industrial wastes, Outfalls.

A study was undertaken to compare two methods of ocean disposal (ocean outfall and ocean dumped) using volatile organic compounds (VOCs) as a measure of waste dispersion. The assessment of the environmental consequences of ocean disposal involves four considerations: waste quality and quantity, method of discharge, and discharge location. When wastes are discharged to the ocean a choice has to be made between barging the waste and discharging through an outfall. A major advantage of outfall disposal is that it is less expensive. Environmental costs may be higher, however, because the coastal zone is an area of high productivity and economic use. When industrial wastes are introduced deep into the water column via a coastal outfall, the coastal environment is not readily flushed of the discharged waste, and waste contamination does impinge on the shoreline. When the waste contains high concentrations of VOCs, as well as high fecal coliforms, it is preferable environmentally to discharge the waste at the surface in the open ocean because the VOCs are more readily lost to the atmosphere than by introduction at depth, and contamination is less likely to reach the shoreline along an economically useful coastal zone. (Baker-IVI)
W85-01963

5F. Water Treatment and Quality Alteration

COST AND BENEFITS OF DRINKING WATER TREATMENT,
Municipal Environmental Research Lab., Cincinnati, OH. Drinking Water Research Div.
R. M. Clark, J. A. Goodrich, and J. C. Ireland.
Journal of Environmental Systems, Vol. 14, No. 1, p 1-30, 1984-85. 15 Fig, 11 Tab, 14 Ref.

Descriptors: *Cost-benefit analysis, *Social costs, *Drinking water, *Water treatment, Cost analysis, Environmental control, Public health, Chlorination, Filtration, Infectious diseases, Activated carbon.

As inflationary and regulatory pressures increase and regulated industries and the public question the usefulness of investing in environmental control measures, a need to relate environmental control costs to their benefits is more apparent. This article develops a framework for evaluating the costs and benefits of environmental control and preventive public health practices and asks the policy question: How do we achieve the best mix of protection against infectious disease and toxic chemicals in drinking water. In an attempt to answer this question, the costs and benefits of chlorination and filtration are analyzed retrospectively, and the results of this analysis extended to include a newer technology, granular activated carbon (GAC) filtration. Both a net benefit and cost per life saved approach is used in the analysis. The issue of uncertainty in estimating benefits and the resulting impact on the selection of an optimal strategy is examined. Net benefits associated with chlorination and filtration are shown to be more than adequate for installation of these technologies; with GAC technology, the relative benefits drop. The best cost benefit relationship for GAC technology results when GAC replaces sand in the filtration scheme. Benefits tend to increase with increasing scale of service. (Author's abstract)
W85-01649

DETERMINATION OF CHLORINE DIOXIDE AND CHLORITE IN DRINKING-WATER (BESTIMMUNG VON CHLORDIOXID UND CHLORIT IM TRINKWASSER),
Technische Univ., Munich (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie.
G. Hartung, and K.-E. Quentin.
Zeitschrift fur Wasser und Abwasser Forschung, Vol. 17, No. 2, p 50-62, 1984. 8 Fig, 4 Tab, 17 Ref.

Descriptors: *Chlorine dioxide, *Chlorite, *Drinking water, *Photometry, Interference, Chlorination, Water treatment.

The photometric determination of iodine at 350 nm after oxidation of iodide by ClO2 at pH 7 or pH 2.5 was shown to be suitable for determination of concentrations of chlorine dioxide down to 0.001 mg/l. Interfering chlorine can be removed so that chlorite only interferes at pH 2.5. For concentration and isolation ClO2 can be stripped with nitrogen or extracted with hexane. In a similar way chlorite can be determined down to 0.001 mg/l after removing chloride dioxide previously by stripping or extraction. Very small quantities of chlorite can be oxidized with sodium peroxydisulfate to chlorine dioxide, which after concentration is determined photometrically. Variations of the method are described together with their procedures. The methods especially pertain to those concentrations of ClO2 and ClO2(-) being used in waterworks and to these recommendations in the new edition of the Trinkwasser-Aufbereitungs-Verordnung (chlorine dioxide up to 0.1 mg/l, in excepted cases up to 0.4 mg/l chlorite up to 0.1 mg/l). (Author's abstract)
W85-01664

ENTERIC VIRUS LEVELS IN WASTEWATER EFFLUENTS AND SURFACE WATERS IN THE SEVERN TRENT WATER AUTHORITY 1979-1981,
Severn-Trent Water Authority, Birmingham (England).
For primary bibliographic entry see Field 5B.
W85-01718

FORMATION OF STABLE ORGANIC CHLORAMINES DURING THE AQUEOUS CHLORINATION OF CYTOSINE AND 5-METHYLCYTOSINE,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
J. P. Gould, J. T. Richards, and M. G. Miles.
Water Research, Vol. 18, No. 8, p 991-999, 1984. 11 Fig, 3 Tab, 13 Ref.

Descriptors: *Chlorination, *Cytosine, *Methylcytosine, *Organic chloramines, Hypochlorous acid, Chlorohydrins, Hydrogen ion concentration, Chlorinated hydrocarbons, Chemical reactions.

The interaction of aqueous hypochlorous acid with the aminopyrimidines, cytosine and 5-methylcytosine has been investigated. Analysis of the reaction mixtures indicated substantial formation of chlorine substitution and addition products with little reduction of chlorine to chloride. Very high levels of combined chlorine were observed. Ultraviolet spectra showed complex patterns of behavior with peak shifts and intensity changes occurring some cases and full loss of aromaticity in others. The latter process was suggestive of addition of HOCl to double bonds with formation of chlorohydrins. The behavior was found to depend on reaction pH and chlorine to base ratios. Thin layer chromatography revealed complex patterns of stable chloramine formation with the reaction mixture complexity tending to increase with increasing pH and FAC/base ratios. Chemical ionization mass spectra disclosed the existence of a number of organic chloramines containing up to three chlorine atoms and, in the case of 5-methylcytosine a major ring cleavage and rearrangement product of as yet undefined structure. The half-life for the decay of the combined chlorine was found to be approx. 3.9 days and to be independent of precursor compound and pH. (Author's abstract)
W85-01726

FORMATION AND REMOVAL OF MUTAGENIC ACTIVITY DURING DRINKING WATER PREPARATION,
Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands). Chemical Biological Div.
H. J. Kool, and C. F. Van Kreijl.
Water Research, Vol. 18, No. 8, p 1011-1016, 1984. 5 Fig, 5 Tab, 19 Ref. Netherland Cancer Society grant RID 80-1.

Descriptors: *Mutagenic activity, *Chlorination, *Ozonation, *Drinking water, Water treatment, Ames test, Filtration, Sand filters, Activated carbon, Mutagens.

The influence of different treatment processes on the mutagenic activity (Ames test) and some chemical parameters in water were investigated in a few waterworks. Application of a chlorine treatment generally increased the direct and promutagenic activity, but the extent increase proved to be dependent on the type of water chlorinated. The use of ozone in the preparation of drinking water decreased the mutagenic activity in the water. The extent reduction was also dependent on the type of water ozonated. Dune filtration greatly reduced the mutagenic activity. Slow sand filtration could not be evaluated, because of the toxicity of the organic concentrates for the bacterial strains. Granular activated carbon filters, in operation for about 1 year, reduced the mutagenic activity below the detection level. A similar filter which has operated for more than 1.5 years in a pilot plant, showed a breakthrough of mutagenic activity suggesting that carbon filters are able to remove organic mutagens for a limited period. The results of the chemical parameters measured before and after the different treatment processes showed that none of these parameters were a reliable indicator for the mutagenic activity. (Author's abstract)
W85-01728

CHLORINE AS AN ALGICIDE IN A CONVENTIONAL WATER TREATMENT PLANT,
American Univ., Beirut (Lebanon). Dept. of Environmental Health.
J. Ibrahim, L. Squires, H. Mitwalli, and M. Taha.
International Journal of Environmental Studies, Vol. 20, No. 1, p 41-46, 1982. 1 Fig, 2 Tab, 12 Ref.

Descriptors: *Water treatment facilities, *Algicides, *Chlorination, *Beirut, *Lebanon, Prechlorination, Algal growth, Tropical regions.

The Beirut, Lebanon, Water Treatment Plant is of conventional design, and processes between 147,000 and 190,000 cu m of water per day. Algae grow abundantly in the various treatment units of the plant, particularly during spring and summer. Algae in the water entering the plant and algae growing within the plant cause severe management and operational difficulties. A study was conducted to determine the dose of chlorine lethal to the algae which were causing operational difficulties. In laboratory experiments, a single dose of 1.8 mg/l of chlorine was sufficient to kill all the algal taxa growing in the plant. If the chlorine dose was regenerated to the original concentration every 24 hours, then a dose of 1.2 mg/l was sufficient. In field studies, continuous dosing of chloride to maintain a residual chlorine level of 0.8 mg/l was found lethal to the algal taxa. Prechlorination is therefore recommended as an effective method for the control of algal growth in conventional water treatment plants in the tropics. (Moore-IVI)
W85-01749

MICROBIAL CONTAMINATION OF POTABLE WATER IN DISTRIBUTION SYSTEMS,
Vermont Univ., Burlington. Dept. of Civil and Mechanical Engineering.
D. R. Hemenway.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202456, Price codes: A03 in paper copy, A01 in microfiche. Vermont Water Resources Research Center Completion Report, September 1983. 25 p, 2 Tab, 5 Ref, 1 Append. Project No. OWRT A-045-VT(1).

Descriptors: *Drinking water, *Potable water, Water distribution systems, *Coliforms, Water conveyance, Enterobacter, Psuedomonas, Flavobacterium, Citrobacter, Aeromonas, Serratia, Klebsiella, Bacteria, *Vermont, Microorganisms, Microbiological studies, Champlain, Rutland City.

Drinking water from two sites in Vermont were sampled and analyzed to examine the relationships among water source, prevailing treatment practices and the quantity and identity of the microorganisms in the distribution systems. Samples of raw water or settled raw water, water immediately after treatment, and at three locations at the end of the distributions systems were taken from the Rutland City water system and the Champlain Water District system. Turbidity, free and total chlorine, pH, conductivity, total coliform count and low power microscopic estimation of the bacteriological densities were performed on each sample. Predominant organisms from the total and fecal coliform and standard plate counts were routinely isolated and identified. Coliform bacteria were not found in the distribution network of either system during the sampling period. Fecal coliform in the raw water at Champlain Water District accounted for approximately 9% of the total coliform count, while in Rutland no fecal coliform were found after prechlorination of the raw water in this system. Seventy-four percent of the organisms identified in the treated water belonged to the Family Pseudomonadaceae. Presumably these organisms colonized the distribution system.
W85-01796

STATUS OF REVERSE OSMOSIS VS. ION EXCHANGE FOR PETROLEUM/PETROCHEMICAL UTILITIES,
H. S. Bourgeois, Jr.
Industrial Water Engineering, Vol. 21, No. 2, p 14-18, 1984. 2 Fig, 4 Tab, 2 Ref.

Descriptors: *Reverse osmosis, *Ion exchange, *Water treatment, *Industrial water, Dissolved solids, Particulates, Membrane processes, Pretreatment, Oil industry.

With the advent of Reverse Osmosis in the late 1960's, an alternative process to straight ion exchange became available to industry for the removal of dissolved solids. Reverse Osmosis (RO) has been utilized extensively in the electronics industry for the preparation of 'ultra-pure' water used primarily in the manufacture of semi-conductors. RO provides the added advantage of essentially complete particulate removal, along with dissolved solids removal, prior to final polishing by ion exchange. There also has been widespread application of RO in conjunction with ion exchange in the electric utility industry to provide feedwater for high pressure steam generators. To date, Reverse Osmosis has seen very limited use in this country in the petroleum/petrochemical industry. This is probably the result of the availability of good quality water supplies in the areas where these industries are located. Since 1979, the costs of regeneration chemicals and ion exchange resins have increased rapidly compared to R.O. membranes and Reverse Osmosis with ion exchange polishing has become economically attractive when compared to straight ion exchange at lower dissolved solids levels. The most important factor in the design and successful operation of a R.O. system is proper pretreatment to protect the membrane against fouling. The principle aspects of pretreatment are discussed followed by an economic evaluation of Reverse Osmosis versus straight ion exchange for three typical Gulf Coast water supplies. (Author's abstract)
W85-01853

DEVELOPMENT OF THE CONDITION OF THE BALDEGGERSEE (1900 TO 1980) AND THE EFFECT OF INTRALAKE PROCEDURES (DIE ZUSTANDSENTWICKLUNG DIS BALDEGGERSEES (1900 BIS 1980) UND DIE AUSWIRKUNG VON SEEINTERNEN MASSNAHMEN),
For primary bibliographic entry see Field 5C.
W85-01865

STATE-OF-THE-ART FOR ELECTRONIC GRADE ULTRAPURE WATER MANUFACTURING AND DISTRIBUTION, PART I,
Anatel Instrument Corp., Boulder, CO.
C. F. Firth, Jr.
Journal of Environmental Sciences, Vol. 27, No. 4, p 22-26, July/August, 1984. 4 Tab.

Descriptors: *Water treatment, *Ultrapure water, Standards, Monitoring, Trace elements, Water quality control, Electronics industry, Reverse osmosis, Ion exchange.

Ultrapure water is essential for producing semiconductor devices. The methods of monitoring trace contaminants, materials of construction, and distribution from the central production area to points of use are very important in designing the right system. Standards are being proposed for levels of water quality by organizations such as the American Society for Testing and Materials to assist the manufacturing and engineering personnel. In the selection of primary treatment, the basic question of reverse osmosis versus ion exchange economics is a never-ending discussion. In the 50-300 milligrams of total dissolved solids per liter range, a decision must be based on the type of contaminants to be removed from the water system. If extensive pretreatment is required to protect the reverse osmosis membrane, then deionization should be considered. If the ultrafiltration characteristics of the RO membrane outweigh the other facts, reverse osmosis is the obvious choice. When the water reaches the polishing stage, the majority of constituents has been reduced to a very low level. The ionic concentration has been controlled and final removal of trace amounts of the dissolved inorganic material requires special steps. It is a misconception to feel that the water has been treated to such a point that the other contaminants have likewise been reduced. (Baker-IVI)
W85-01873

EXECUTION OF SOCIALIST BUSINESS MANAGEMENT IN THE CONTINUATION OF THE COLBITZ MOVEMENT (DIE DURCHSETZING DER SOZIALISTISCHEN BETRIEBSWIRTSCHAFT IN FORTFUHRUNG DER COLBITZER BEWEGUNG),
VEB Wasserversorgung und Abwasserbehandlung, Magdeburg (German, D.R.)
R. Wernecke.
Wasserwirtschaft-Wassertechnik, Vol. 34, No. 1, p 17-18, January, 1984. 4 Ref.

Descriptors: *Water treatment, *Colbitz, *East Germany, Costs, Management, Water use, Optimization, Water treatment facilities, Automation.

At the Colbitz waterworks, German Democratic Republic, efforts were begun at the end of 1970s to increase performance. Waterworks capacity was increased by 154,000 cu m/day between 1976 and

1982, the goal being a total increase of 204,600 cu m/day by 1985. During the same period, water losses increased from 10 to 11%, supply of water demand rose from 75.9 to 92.0%, 68 jobs were eliminated, and annual production costs dropped by 1.0-1.5 million Marks. This was achieved by improving weak spots in the production process without expanding the facility. The second step of the movement consisted of rationalization of water use and optimization of water network operation. Optimal models for the Colbitz-Letzlinger Heide underground reservoir and operation of the Magdeburg network were developed. Analyses were made of scientific and technological developments with regard to their impact on the workforce and on the quality of water and water facilities. Workers will have to be more highly educated in future, as the introduction of micro-electronics is inevitable. For further development of the Colbitz movement, the Magdeburg water-supply and wastewater-treatment facility was given the task of finding new methods of automation and process control. Intensive analyses of the production process were carried out, in particular, analysis of existing conditions as a basis for the development of a concept for optimal production. The introduction of an achievement-oriented pay scale is important. (Gish-IVI)
W85-01876

CONSTRUCTION OF RATIONALIZATION EQUIPMENT AT THE ROSTOCK WATER-SUPPLY AND WASTEWATER-TREATMENT FACILITY (RATIONALISIERUNGSMITTELBAU IM VEB WASSERVERSORGUNG UND ABWASSERBEHANDLUNG ROSTOCK),
VEB Wasserversorgung und Abwasserbehandlung, Rostock (German, D.R.).
G. Schofer.
Wasserwirtschaft-Wassertechnik, Vol. 34, No. 1, p 19-20, January, 1984. 3 Fig.

Descriptors: *Water treatment facilities, *Wastewater treatment facilities, *Rostock, *East Germany, Chlorination, Water treatment, Filtration, Automation.

A workshop was given to the Rostock water-supply and wastewater-treatment facility for the purpose of building rationalization equipment beginning in 1977. During its first year, the workshop produced equipment worth 70,000 Marks, increasing to 338,000 Marks in 1980. Construction of rationalization equipment on-site plays a large part in the 1981-85 five year plan, especially in terms of industry-specific items that cannot be completed elsewhere or provided by East German businesses, modernizing existing equipment, and producing spare parts. At Rostock, industry-specific equipment has been developed in innovator collectives and has resulted in the construction of a transportable drinking water treatment station, a transportable pressure station, a chlorine-dosage station that can be mounted on a trailer, electronic transmitter measurement, and automatic filter aeration and ventilation. The water-treatment station was designed for backup during reconstruction or heavy pollution but could also be used as an independent waterworks in rural areas. (Gish-IVI)
W85-01877

COMPUTERIZED DISTRIBUTION RECORDS-CADD PAVES THE WAY,
Donohue and Associates, Inc., Waukesha, WI.
J. F. Curtiss, and P. A. Lohmiller.
Journal of the American Water Works Association, Vol. 76, No. 7, p 56-61, July, 1984. 3 Fig, 2 Tab, 4 Ref.

Descriptors: *Computers, *Water distribution, *Leakage, Water audit, Mapping, Sewer systems, Water conveyance.

The findings of a water audit and leak detection investigation generated input for a new computer-aided drafting and design system (CADD) for the city of Des Plaines, Ill. Installation of the computerized system will upgrade the usefulness and accuracy of documents pertaining to the city's water and sewer systems. Immediate benefits were realized from the discovery of significant leakage, and long-range benefits will be realized from the inherent flexibility of the CADD system and the ease with which up-to-date records can be maintained. Graphic overlays on base maps of the city can be generated in hard-copy form to produce the graphic and nongraphic data needed for a given use. These data, stored in CADD, will also be of use to other municipal departments. (Author's abstract)
W85-01902

MICROCOMPUTER PROGRAMS FOR DESIGNING WATER SYSTEMS,
Public Works Dept. of Malaysia, Kuantan.
For primary bibliographic entry see Field 8A.
W85-01903

CALIBRATING WATER SYSTEM MODELS,
Denver Water Dept., CO.
A. L. Cesario, and J. O. Davis.
Journal of the American Water Works Association, Vol. 76, No. 7, p 66-69, July, 1984. 8 Ref.

Descriptors: *Water conveyance, *Model studies, *Computers, Water distribution, Calibration.

Calibration of network models is an integral part of water distribution system analysis. Telemetry data and field measurements of the system provide base data for calibration, but computer programs that automatically extract and compare pertinent data with simulated values can aid the process. Calibration establishes the credibility of the model that is used as a benchmark case for studies and as a predictor. Sources of error or inaccuracies include improper network definition or demand distribution, or both. The degree of confidence as a model should be fine-tuned is related to the complexity of the model and to the purpose of the study. A thorough knowledge of operation and performance of the system is gained through the process of calibration. This may be more important than the degree of accuracy of calibration, since modeling is often more concerned with changes than with absolute values. (Moore-IVI)
W85-01904

COMPUTER MODELING IN WATER SYSTEM PLANNING AND DESIGN,
Krebs (Paul B.) and Associates, Inc., Birmingham, AL.
R. U. Harris.
Journal of the American Water Works Association, Vol. 76, No. 7, p 78-81, July, 1984. 2 Fig, 7 Ref.

Descriptors: *Computer models, *Water distribution, *Design, *Planning, Simulation, Model studies, Water demand, Water use, Hydraulic design, Emergency demand.

Benefits that can be derived from the use of hydraulic network computer modeling and analysis in the planning and design of water systems include: data management; evaluation of variations in consumption; simulation of emergency water demands; effect of new water demands; optimization of system operation; long-range planning, facility design, and comprehensive knowledge of the system. Case studies of applications in Charlottesville, Va., Decatur, Ala., and Opelika, Ala. are presented. The availability of low-cost, efficient hydraulic network analysis computer software, and the continuing reduction in the cost of computer hardware, enhances the benefits of simulating the hydraulic conditions of water systems with properly developed and calibrated models. (Moore-IVI)
W85-01906

COMPUTER-ASSISTED WATER SYSTEM ANALYSIS AND DESIGN FOR CHARLESTON, S.C.,
CH2M Hill, Montgomery, AL.
R. E. Topping, and R. J. Puccia.
Journal of the American Water Works Association, Vol. 76, No. 7, p 83-89, July, 1984. 3 Fig, 4 Tab, 5 Ref.

Descriptors: *Computer models, *Water distribution, *Charleston, *South Carolina, Cost analysis, Pipes, Water storage, Pumps, Energy costs.

A computer model was developed and used to analyze all components of the Charleston, S.C. water distribution system in anticipation of improving the system to meet future demands. After limitations and deficiencies were identified, cost-effective improvements to piping, storage facilities, service pumps, and booster pumps were recommended. An improved operations program, which included a power management plan that resulted in substantial savings in energy costs, was also determined with the computer model. (Author's abstract)
W85-01907

FLOCCULATION MODEL TESTING: PARTICLE SIZES IN A SOFTENING PLANT,
Texas Univ. at Austin. Dept. of Civil Engineering.
D. F. Lawler, and D. R. Wilkes.
Journal of the American Water Works Association, Vol. 76, No. 7, p 90-97, July, 1984. 13 Fig, 1 Tab, 25 Ref. EPA grant R-808192-01.

Descriptors: *Flocculation, *Particle size, *Water treatment, Mathematical models, Fluid shear, Turbidity, Suspended solids.

Designing an efficient and cost-effective flocculation unit has always been a challenge to engineers. Measurements of its capability have necessarily been after the fact - examining turbidity or suspended solids concentration after settling. Particle-size-distribution analyses during flocculation more closely reflect the actual process but are difficult, time-consuming, and prone to sampling errors. Research using Smoluchowski's equation has led to a mathematical model for the process of flocculation. This model was tested against actual treatment plant performance for particle size distribution. Using different conditions, the model successfully predicted changes in small or large particles, but not both. The model compared favorably with most experimental results but needs improvement to predict the effects of changes in fluid shear and particle concentration. (Author's abstract)
W85-01908

LOWER DETECTION LIMITS FOUND FOR CHLORINE DIOXIDE CONTAMINANTS,
Miami Univ., Oxford, OH. Dept. of Chemistry.
G. Gordon, and Y. Ikeda.
Journal of the American Water Works Association, Vol. 76, No. 7, p 98-101, July, 1984. 3 Tab, 23 Ref.

Descriptors: *Chlorates, *Chlorites, *Chlorine dioxide, Water analysis, Disinfection, Water treatment, Hypochlorites, Idometry, Potentiometry.

Chlorine dioxide disinfection of water eliminates trihalomethane formation but generates chlorate and chlorite ions. Government regulations under consideration would require the removal of these by-products to levels for which no detection methods exist. An iodometric-potentiometric method is developed to measure chlorate, chlorite, and hypochlorite ions, even in mixtures that contain high hypochlorite ion concentrations such as those frequently observed in a water treatment plant. This method can also be used to determine directly the concentration of chlorite ion, in contrast to other indirect methods. Measurements of synthetic mixtures that contain these ions can be carried out with an accuracy of + or - 3% at the 0.3-mg/L level, with lower limits of 0.1 mg/L. (Moore-IVI)
W85-01909

SEDIMENTATION SUCCESS FROM MODIFIED JAR TESTS,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
G. D. Reed, and D. A. Reece.
Journal of the American Water Works Association, Vol. 76, No. 7, p 101-105, July, 1984. 8 Fig, 1 Ref.

Descriptors: *Sedimentation, *Jar tests, *Wastewater treatment, Turbidity, Filtration, Flocculants, Hydraulic comparison equation, Flow rate, Residence time.

Delivery of clear water from settling basins to filtration systems is important for the smooth operation of a treatment plant. But operators work at a disadvantage when they cannot determine what is happening during the sedimentation process. Incomplete settling allows turbid outflows to reach filters, shortening their runs and adding to water quality costs. A modified jar test method for modeling basin behavior has been designed. It uses a hydraulic comparison equation sensitive to basin flow rates, water residence times, and flocculant dosages. When properly calibrated, it can reflect actual basin performance, detect problems, and point to areas where solutions may be found. (Author's abstract)
W85-01910

ANN ARBOR CONTROLS TRIHALOMETHANES,
Michigan Dept. of Public Health, Lansing.
R. S. Sacks.
Journal of the American Water Works Association, Vol. 76, No.7, p 105-108, July, 1984. 6 Fig, 3 Tab, 6 Ref.

Descriptors: *Trihalomethanes, *Water treatment, *Ann Arbor, *Michigan, Drinking water, Disinfection, Chlorine, Chloramines, Anhydrous ammonia, Halogenated hydrocarbons.

A maximum contaminant level (MCL) was established by the EPA for total trihalomethanes (TTHMs) in public drinking water supplies. Many water treatment plants need new methods to control the formation of trihalomethanes as by-products of existing disinfection practices. The city of Ann Arbor, Michigan experimented with a variety of disinfection schemes using chlorine and chloramines. Anhydrous ammonia, added to the raw water after prechlorination, reduced TTHM concentrations to required levels without sacrificing bacteriologic quality, as determined by routing plate count samples. (Moore-IVI)
W85-01911

EFFECT OF TREATMENT WITH A COMMERCIAL BACTERIAL SUSPENSION ON WATER QUALITY IN CHANNEL CATFISH PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
C. E. Boyd, W. D. Hollerman, J. A. Plumb, and M. Saeed.
Progressive Fish Culturist, Vol. 46, No. 1, p 36-40, January, 1984. 3 Fig, 1 Tab, 11 Ref.

Descriptors: *Catfish farming, *Bacteria, *Biological treatment, *Water pollution treatment, Saprophytic bacteria, Bacillus, Nitrobacter, Pseudomonas, Aerobacter, Cellulomonas, Rhodopseudomonas, Nitrogen, Phosphorus, Chemical oxygen demand, Biochemical oxygen demand, Chlorophyll a, Cyanophyta, Phytoplankton, Fish farming, Aquaculture.

Water quality deterioration and off-flavor in fish are common problems in the commercial culture of channel catfish (Ictalurus punctatus). Four I. punctatus ponds were treated with a commercial suspension of saprophytic bacteria (Aqua-Bacta-Aid) consisting of Bacillus, Nitrobacter, Pseudomonas (two strains), Aerobacter, Cellulomonas, and Rhodopseudomonas. Concentrations of inorganic nitrogen, total phosphorus, chemical oxygen demand, 5-day biochemical oxygen demand, and chlorophyll alpha; numbers of bacteria and phytoplankters per milliliter; and percentage of bluegreen algae did not differ significantly ($P > 0.05$) between treatments on any sampling date. On three sampling dates between mid July and mid August, there were significantly higher ($P < 0.05$) dissolved oxygen concentrations in the morning and in the afternoon on ponds treated with the bacterial suspension. Fish production did not differ between treatments ($P > 0.1$). The bacteria applied in the suspension are common saprophytic bacteria that are known to inhabit freshwater and terrestrial environments. The quantity of bacteria applied was quite insignificant compared to the natural bacterial community. (Collier-IVI)
W85-01922

DATA BANK FOR WATERWORKS AND FACILITIES - GOALS AND PROBLEM-SOLVING CONCEPT (DATENBANK WASSERWERKE UND ANLAGEN - AUFGABEN UND LOSUNGSKONZEPTION),
Institut fuer Wasserwirtschaft, Berlin (German D.R.).
E. Tutsch, and H. Weruschek.
Wasserwirtschaft-Wassertechnik, Vol 33, No. 2, p 46-49, February, 1983. 2 Fig, 2 Tab, 4 Ref.

Descriptors: *Water treatment facilities, *Computers, *East Germany, Data processing, Data storage and retrieval, Data collections, Planning, Water quality Water supply.

The goal of a data bank projected for German Democratic Republic waterworks and facilities is to provide decision-making information with regard to materials and energy use, to improve the cost-benefit ratio, and to secure the water supply. The data bank will be instrumental in the development of one-year, five-year, and long-range plans. Studies of user information needs showed that data analysis should be supplied in the areas of facility capacity, water quality, technology and operating regimes, planning for facility construction/expansion, and maintenance. The projected data bank will be centralized. Primary data will be very heterogeneous, comprising about 80% of total stored data (the remaining 20% being results and control data) and consisting of core data, e.g., technological, construction, economic, and capacity figures; aperiodic variable data, e.g., damages, run times; and periodic variable data, e.g., water quality, groundwater conditions, energy consumption. The project will require a mainframe computer; (an ESER ES 1040 or 1055). Four developmental stages are planned: creation of core data from waterworks, pressure increasing facilities, reservoirs, and water-supply areas, of the analysis call-up system, frame program, and universal analysis program system; integration of data from water-intake facilities and wells; integration of data from water-treatment plants and completion of data search capability; integration of water-conveyance data and capability for input and output via CRT. (Gish-IVI)
W85-01969

OBSERVATIONS FROM THE TEST OPERATION OF AN ION-EXCHANGE FACILITY FOR NITRATE REMOVAL IN DRINKING-WATER TREATMENT (ERFAHRUNGEN AUS DEM ERPROBENGSBETRIEB EINER IONENAUSTAUSCHERANLAGE ZUR NITRATELIMINATION IN DER TRINKWASSERAUFBEREITUNG),
Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie.
K. Wiegleb, C. Scholze, S. Bierhals, and H. Elsner.
Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 69-70, February, 1983. 1 Tab, 5 Ref.

Descriptors: *Ion exchange, *Nitrates, *Water treatment, *Gera, *East Germany, Drinking water, Chlorides, Regeneration, Automation.

An ion-exchange facility (IE) for the removal of nitrate in water treatment has been in use since 1980 at the Gera (German Democratic Republic) water- and wastewater-treatment plant. Its capacity is 200 cu m/-day. Before treatment, the water contains 40-70 mg/l NO3(-) and 12-30 mg/l Cl(-). Expressed in effective volume capacity (EVC), nitrate elimination corresponded well to a previously published model, despite differing operating conditions. Nitrate levels in treated water were depending on regenerating conditions 10-18 mg/l, which was 2-7 mg/l above those predicted for small facilities. These results were not achieved and required a longer operating cycle. The increase in chloride produced by the IE in treated water also corresponded well to the published theory with levels of 80-120 mg/l. MgCl2 brine was chosen as the regeneration chemical, so that the concentrated portion of wastewater produced by regeneration of total wastewater (about 16%) could be used for melting snow on the streets. The concentrated wastewater consisted of elutriate and rinse water, which was collected separately from the remaining regeneration wastewater and contained > 5-10 g/l chloride (10-15% salt solution). Frequent problems occurred in automatic nitrate measurement, requiring changing the membrane, refilling the electrode with electrolytes, and removing air bubbles from the reference electrode. Total automation or regeneration every 3-7 days is recommended for small facilities to ensure economical operation and compliance with standards for nitrate in drinking water. (Gish-IVI)
W85-01974

APPROPRIATE WATER SUPPLY TECHNOLOGY FOR DEVELOPING COUNTRIES,
I. Mirchandani.
Aqua, No. 1, p 11-18, 1983. 9 Fig.

Descriptors: *Water supply development, *Developing countries, *Ethiopia, Hydrams, Ponds, Windmills, Springs, Pumps, Dams, Drinking water, Storage reservoirs, Water storage, Cisterns, Appropriate technology.

In Ethiopia only 4 to 5% of the people in rural areas have access to drinking water, and it is unlikely that the entire population of the country will have access to potable drinking water in the next few decades. Innovative practices within the capacity of the community to implement can lead to universal use of potable drinking water and consequent improvement in health standards. Existing sources of supply of water can be used with improvements that enable communities to use the same water but in an uncontaminated form as per acceptable standards. Appropriate technologies consist of use of ponds, spring development, hydrams, windmills, current water lift pumps, rain water storage, subsurface dams, and monitoring of ground water resources in drought affected areas. (Wheatley-IVI)
W85-01981

PRACTICAL WATER TREATMENT FOR COMMUNITIES IN DEVELOPING COUNTRIES,
North Carolina Univ. at Chapel Hill. Area Health Education Centers Program.
D. A. Okun, and C. R. Schulz.
Aqua, No. 1, p 23-26, 1983. 6 Fig, 1 Tab, 6 Ref.

Descriptors: *Water treatment, *Appropriate technology, *Developing countries, Economic aspects, Filtration, Coagulation, Sedimentation, Coagulants, Flocculation, Groundwater, Drinking water.

Rather than transferring water treatment technology from industrialized countries to developing countries, simple low maintenance methods are more practical. Groundwater is the preferred choice for community water supplies, as it generally does not require treatment. If no suitable aquifers are available, relatively clear waters from lakes or streams are best treated by slow sand filtration. Pretreatment may be provided by plain sedimentation or horizontal roughing filters prior to slow sand filtration. Only as a last resort should chemical coagulation and rapid sand filtration be adopted. Even then, only simple, practical technologies such as hydraulic rapid mixing and flocculation, horizontal-flow sedimentation, and manually operated filters should be used. Methods of utilizing self-backwashing filters are suggested incorporating the flow from other filter systems and altered water levels. The use of natural coagulants in water treatment is one economic technology presented. Locally available plant materials can be used, such as seeds of the nirmali tree, extracts from the tamarind tree, guar plant, and red sorella plant. Fenugreek and lentils can be utilized for effective coagulants. Chitosan from exoskeletons of arthropods is one of the most effective coagulants available.
W85-01983

WATER SUPPLY OF ALEXANDRIA EGYPT,
Zurich Water Supply (Switzerland).
M. Schalekamp.
Aqua, Vol. 1983, No. 1, p 31-41, 1983. 20 Fig, 4 Ref. (In English and French).

Descriptors: *Water treatment, *Potable water, *Egypt, *Alexandria, Nile River, Canals, Flocculation, Coagulation, Settling basins, Water supply development.

Alexandria, Egypt, obtains its water primarily from the Nile River. Because of evaporation and other water loss mechanisms, most of this water is transported via artificial canals. Water treatment is relatively simple: flocculation and filtration. A review of the main water treatment facilities is given. An expansion of water treatment and delivery systems is underway. New pumping plants and pipelines are being constructed with more that 70 million Egyptian pounds being spent from 1978 to 1981. In order to meet the forecasted needs for high quality water for Alexandria and environs, extensive construction and financial plans are being formulated. (Wheatley-IVI)
W85-01985

ALL ABOUT OZONE - ITS ADVANTAGES AND DISADVANTAGES IN TREATING WATER,
Zurich Water Supply (Switzerland).
M. Schalekamp.
Aqua, No. 3, p 89-96, 1983. 38 Fig, 21 Ref.

Descriptors: *Water treatment, *Ozonation, *Switzerland, Review, Disinfection, Monitoring, Ozone, Drinking water.

The history of the use of ozone in Switzerland as an agent for water treatment is briefly reviewed. Tests conducted in Zurich and St. Gall reveal that soundly-treated and ozonized water should in no way enhance regermination of microorganisms in the water mains any more than nonozonized water. This is confirmed also by those Swiss waterworks which ozonize their ground and spring water and do not notice any form of regermination in their water mains. A comparison is made of the effects of treating water with 1 or 5 mm ozone/liter. With regard to the destruction of bacteria and inactivation of viruses in water of not too high a degree of contamination, a higher concentration of ozone than 1.0 to 1.5 is not needed. Before selecting the proper dosage, an exact analysis is needed as to what the ozone is to be required to do. Ways to monitor and control the ozone concentration of the water and in the exhaust air of treatment plants are described. (Baker-IVI)
W85-01986

STUDY OF MUTAGENIC ACTIVITY IN WATER IN A PROGRESSIVE OZONATION UNIT (ETUDE DU CARACTERE MUTAGENE DE L'EAU DANS UNE FILIERE DE PRODUCTION A OZONATION ESTAGEE),
Compagnie Generale des Eaux, Paris (France).
M. M. Bourbigot, J. L. Paquin, L. H. Pottenger, M. F. Blech, and P. Hartemann.
Aqua, No. 3, p 99-102, 1983. 3 Fig, 2 Tab, 13 Ref.

Descriptors: *Ozonation, *Mutagenic activity, *Water treatment, Drinking water, Activated carbon, Chlorination, Toxicity.

Samples of water were collected at various points along a drinking water treatment process which includes several ozonation stages, activated carbon filtration and postchlorination. They were concentrated on XAD-4 and XAD-8 resins (x 700 at 10,000), and eluated with DMSO. The concentrates were assayed o two strains of Salmonella typhimurium (TA 98 and TA 100) and on Chinese hamster lung cells (V79). The mutagenecity test on V 79 cells was more sensitive and provided more information than the bacteria test, and allowed determination of mutagenic, initiator and promoter activities. These appeared only in the raw river and at the head of the treatment line. With the bacteria test, the positive results were obtained only on strain TA 98. No mutagenic activity was found in samples of water from the final treatment stages. The results obtained with ozonated water seemed to indicate that optimization of ozone treatment improves the water's characteristics with respect to potentially mutagenic organic molecules. With an adequate ozone dosage, the mutagenic and promoter activities disappear. (Author's abstract)
W85-01987

NICE ON THE FRENCH RIVIERA - THE BIRTHPLACE OF DRINKING WATER TREATMENT WITH OZONE (NICE, SUR LA RIVIERA FRANCAISE - BERCEAU DU TRAITEMENT DE L'EAU PAR L'OZONE),
Compagnie Generale des Eaux, Paris (France).
P. Decourcelle.
Aqua, No. 3, p 105-110, 1983. 9 Fig.

Descriptors: *Nice, *France, *French Riviera, *Ozonation, *Drinking water, *Water treatment facilities, Disinfection, Filtration, History.

It was in 1904 that the Nice Administration decided to provide the municipal waterworks with facilities for disinfection of water with ozone - the very first in the world. The plant was also to serve as a center for the study of effects of ozone on water, carried out by Marius-Paul Otto, a researcher from Nice. The waterworks was named Bon-Voyage and, at the start provided treatment at a rate of 100 cu m/h. Following receipt of favorable results, the plant's production rate was increased several fold in 1907 to exceed 22,500 cu m/day, and the Nice Administration went ahead with construction of a waterworks using ozonation at Rimiez; then again in 1925, a third one at Saint-Pierre de Feric. The latter two could each accommodate a disinfection rate of 13,000 cu m/day. Soon after, in rapid succession, ozone disinfection procedures were adopted for the use in all cities on the French Riviera situated between Nice and Menton. It is common knowledge now that the popularity of ozone has since spread throughout the world. Continued population growth had, by 1935, necessitated supplementing the surface water supply with groundwater sources which were derived, by a system of wells installed along the riverbank, from aquifers in the Var region. Thus, a pumping rate of 90,000 cu m/day has been attained with a water made naturally potable thanks to the good filtration capacity of the Var gravel beds. In 1969, the municipal administration decided to replace the three waterworks employing ozonation (as they now had become insufficient to meet city needs and the equipment was timeworn) with only one plant, able to function at a rate of 90,000 cu m/day; the Super-Rimiez Treatment Plant, inaugurated in 1972. Water here is treated using the latest techniques including, of course, ozonation. The architecture and landscaping of this waterworks have been especially successful. In 1982, the Jean Moreno plant producing 90,000 cu m of potable water per day, including an ozonation stage, was inaugurated. (Author's abstract)
W85-01988

CONTROL OF METAL CONTAMINANTS IN DRINKING WATER IN DENMARK,
Korrosionscentralen ATV, Glostrup (Denmark).
K. Nielsen.
Aqua, No. 4, p 173-182, 1983. 15 Fig, 15 Ref.

Descriptors: *Drinking water, *Denmark, *Plumbing, *Trace metals, *Heavy metals, Domestic water, Lead, Cadmium, Nickel, Copper, Zinc.

Traces of metals are dissolved when water is transported in mains and in house installations. Some of these metals are toxic at sufficiently high concentrations. Even when lead pipes are not used, lead can be picked up from house installations in considerable amounts. Cadmium can be found in small amounts in both pipes and fittings, but it can and should be avoided. High concentrations of other metals such as nickel, copper and zinc should be prevented in drinking water. Field tests were made on metal pick-up from galvanized steel pipes of different manufacture, from brasses and from gun metal. Observations were made in three different types of water over a six-month period. A modified test method was developed for judging the magnitude of metal pick-up from fittings in drinking water installations. Pick-up of lead and cadmium from new house installations in Denmark is kept sufficiently low by the following measures: the use of lead-containing soft solder or cadmium-containing brazing metal for joining copper tubes is forbidden; and only approved fittings, tap valves, and other equipment to be installed may be used. The approval procedure includes a test for cadmium and lead pick-up. (Author's abstract)
W85-01993

REPORT ON THE WATER SUPPLY OF THE PEOPLE'S REPUBLIC OF CHINA,
Zurich Water Supply (Switzerland).
M. Schalekamp.
Aqua, No. 5, p 205-212, 1983. 30 Fig, 6 Ref.

Descriptors: *China, *Water supply, *Drinking water, *Water management, Resources management, Water resources development, Water supply development.

For the last four thousand years China has been the water-problem country par excellence. There were either big droughts or catastropic floods, which destroyed agricultural growth. Today, after the most immense effort - e.g. for the prevention of flood catastrophies 160 000 km of dams have been constructed along the rivers and more than 10 000 storage lakes with a total capacity of 400 billion cubic meters for regulation of run-off water, were realized. This means that now 75% or 75 million hectares of agricultural land are protected against such destruction. Everyone in China, whether they live in the country or the towns, is supplied with water. In rural areas 50% of the population receive their water from wells, i.e. the water must be fetched from the well and from the stand pipe, but at least it is clean. The other 50% of the rural population are supplied with water by means of a simple pressure water system and have one or two water taps in their houses. In the cities the largest part of the inhabitants are connected to a pressure water supply system. The Water Supply Beijing distributes 95% groundwater and 5% treated surface water. It is just the opposite in Shanghai. The city delivers 5% groundwater and 95% treated river water. In Beijing the water is hard. There are no quality problems only domestic problems with the calcification. Shanghai, on the other hand, has no domestic problems but quality problems, because the river is being increasingly polluted by waste water. The price of water amounts to 12 Fen or about SFr.0.13 per cubic meter. Compared to the gross national product per inhabitant of Switzerland, a cubic meter of water would cost 35 to 40 times as much or, expressed in Swiss Francs about 4.20 to 5.20. Considering the purchasing power then, our ancestors, one hundred years ago, had to pay the same price for water. (Author's abstract)
W85-01995

BACTERIA IN WORKS AND MAINS FROM GROUND WATER SUPPLIES,
Aarhus Univ. (Denmark). Inst. of Hygiene.
G. J. Bonde.
Aqua, Vol. 5, p 237-239, 1983. 1 Fig, 7 Tab, 7 Ref.

Descriptors: *Bacteria, *Water quality control, *Groundwater, *Water distribution, Microorganisms.

Many changes taking place in the numbers of microorganisms found in water between the works and the consumer premises are investigated. Tests are outlined to identify these organisms, and growths at different temperatures are recorded. These bacteria can spoil food, cause offensive taste and odor problems or give rise to discolored water. A total of 268 samples were examined: 118 from waterworks plants, 150 from mains. The counts at 30 degrees C show a rather uniform distribution as to magnitude in mains and works, although there is a tendency to slightly higher counts from the works. Counts at 21 and 37 degrees C, however, show more distinct differences. The counts obtained at these temperatures show a bimodal distribution, which supports theories of pollution and regrowth of different types of organisms. In distribution systems in tall buildings quite high temperatures may be attained during stagnation as over the weekends. Satisfactory supplies deteriorated in 46% of the hospital samples. In temperate water systems high counts of 10,000-50,000 per ml were found regularly and occasionally in ordinary supplies. (Baker-IVI)
W85-02001

FIRST EXPERIENCES WITH A WOMEN-SPECIFIC PROJECT FOR THE WATER DECADE,
S. A. A. Jahn.

Aqua, No. 6, p 275-276, 1983. 3 Ref.

Descriptors: *Developing countries, *Water treatment, *Sudan, Education, Drinking water, Flocculation, Turbidity, Water resources development, Coagulation.

Methods by which turbid waters may be used and cleaned using naturally occurring coagulation materials are described. Efforts are underway to train the local women in rural Africa (Northern Sudan) to make use of these methods in supplying their families with an adequate and clean water supply using water from rivers, irrigation canals, rain ponds, and artificial rain water storage basins. One method makes use of a simple village jar test. The response of different types of rural women to this clarification project is described. (Baker-IVI)
W85-02004

REMOTE MONITORING AND OPTIMISATION OF PUMPING AT THE SYNDICAT DES EAUX OF LA HAUTE-LOUE (TELESURVEILLANCE ET OPTIMISATION DU POMPAGE DU SYNDICAT DES EAUX DE LA HAUTE-LOUE),
P. Musquere, M. Dumontel, M. Bouverot, and B. Maison.
Aqua, No. 6, p 279-284, 1983. 8 Fig.

Descriptors *Drinking water, *Water treatment, *Water distribution, Computers, Economic aspects, Rural areas.

For a long period of time the automation of treatment of drinking water has been limited to large networks because the magnitude of the problems justified the use of data processing to find the solutions. With recent innovations it is possible that these techniques may soon be applied to medium sized rural networks at a reasonable cost. Remote monitoring and automatic control systems, simple but effective, can solve many problems and improve the service offered. Specific use of these modern techniques to solve problems at the Company Gaz et Eaux which is a subsidiary of the Lyonnaise des Eaux is cited as an example. The results of the experimental efforts conducted at this location appear to be promising. (Baker-IVI)
W85-02005

AUTOMATED SENSOR SYSTEMS FOR WATER RESOURCE POLLUTION WARNING AND TREATMENT PROCESS CONTROL,
Sunderland and South Shields Water Co. (England).
J. F. Wallwork, and G. Ellison.
Aqua, No. 6, p 313-320, 1983. 3 Fig, 1 Tab, 15 Ref.

Descriptors: *Monitoring, *Automation, *Water pollution, *England, Water treatment, Sensors, Rivers, Intakes.

Definition is given for an automated sensor system and its functional requirements are stated in relation to pollution warning and treatment process control. The choice of individual parameters to be continuously monitored is described for a river monitoring station which is charged with protecting a direct river abstraction water treatment works in North East England. Five years of operational experience of the station is reviewed with information given on improvements carried out at the station during that time period. General criteria are offered for automated sensor systems and areas where development of such systems are needed. (Baker-IVI)
W85-02010

REVIEW OF THE WATER SUPPLY IN THE SOVIET UNION,
Zurich Water Supply (Switzerland).
M. Schalekamp.
Aqua, No. 1, p 9-16, 1984. 24 Fig, 1 Tab.

Descriptors: *USSR, *Water supply, *Drinking water, Groundwater, Water quality standards, Water pollution control, Ozonation, Disinfection.

In terms of land area, the Soviet Union is the largest country in the world. For their drinking water supplies, the major cities such as Moscow depend almost entirely on surface water. The water supplies of the smallest cities and towns, as well as those in the rural districts, have sufficient groundwater available for their needs. In the Soviet Union 40% groundwater and 60% surface water are distributed. There are quality standards for raw water and for drinking water and laws are in force for the protection of the drinking water resources against pollution. On the average 650 l/person day are required in Moscow, i.e. 5.2 million cu m/day. All the water passes a very intensive treatment system. The largest ozone facility in the world with a capacity of 200 kg ozone/h is situated in the eastern part of Moscow. For water treatment in rural areas simple processes, which are however very effective, are in operation. In the whole country water can be drunk from the tap without any misgivings. Generally speaking, the water supply bodies are of a good standard. (Author's abstract)
W85-02012

MATARA WATER SUPPLY PROJECT IN SRI LANKA,
National Water Supply and Drainage Board, Colombo (Sri Lanka).
N. D. Peiris, and J. N. Jones.
Aqua, No. 1, p 17-25, 1983. 4 Fig, 1 Tab, 2 Ref.

Descriptors: *Water supply development, *Water management, *Sri Lanka, Design criteria, Water demand, Water supply, Developing countries.

Existing problems of a typical water supply operating in a developing country with system capacity well below present demands are delineated. The system has a cost recovery system which is inadequate to finance effective maintenance. There is also a lack of technical skills. The design philosophy adopted here has been to keep the supply system basic and straightforward, making best use of gravity for trunk and distribution systems, rationalizing pumping systems, designing treatment systems using minimum simple robust and easy to maintain mechanical and electrical plants and easy to operate with seim-skilled labor. The overall system is capable of extension both eastwards and westwards and there is sufficient capacity to meet the predicted demands for the year 2000. (Baker-IVI)
W85-02013

APPROPRIATE TECHNOLOGY TO IMPROVE DRINKING WATER QUALITY,
Techno-Consult, Karachi (Pakistan).
S. Ahmad, M. T. Wais, and F. Y. R. Agha.
Aqua, No. 1, p 26-31, 1984. 7 Fig, 2 Tab, 12 Ref.

Descriptors: *Water quality control, *Drinking water, *Water treatment, *Appropriate technology, Turbidity, Sedimentation, Urban areas.

Experimental results indicated that plain sedimentation could be effective as a pretreatment process to reduce the turbidity of raw water to as low as 10 NTU. Plain sedimentation is an appropriate technology to improve the quality of treated water and its aesthetic appearance especially in a developing country where skilled plant operation for the successful control of alum coagulation is absent. Apart from the direct effect of poor quality of the treated water on the community, it has an indirect adverse effect on the water supply system. For urban water management in a developing country, simple technical and technological alternatives should be given due consideration because of numerous factors like educational background, technical skill and surveillance attitude of local plant operators. (Baker-IVI)
W85-02014

2001 ... THE FUTURE OF WATER TREATMENT (2001 ... L'AVENIR DU TRAITEMENT DE L'EAU),
Compagnie Generale des Eaux, Paris (France).
For primary bibliographic entry see Field 6A.
W85-02017

DRINKING WATER IN DEVELOPING COUNTRIES - THE MINIMUM TREATMENT PHILOSOPHY. A CASE STUDY,
Norconsult A/S, Sandvika (Norway).
For primary bibliographic entry see Field 3B.
W85-02018

OZONATION AND ACTIVATED CARBON FILTRATION: A CRITICAL EVALUATION,
J. G. Janssens, F. Van Hoof, and J. Dirickx.
Aqua, No. 2, p 102-107, 1984. 6 Fig, 9 Tab, 7 Ref.

Descriptors: *Ozonation, *Activated carbon, *Filtration, Water treatment, Organic carbon, Chlorination, Drinking water.

Ozonation should not be considered as an additional treatment unit process, but rather as an integrated process in the total water treatment system. The value of ozonation should therefore always be assessed as a function of its impact on the other process of which a treatment line is composed. The conclusion of the present study can be summarized as follows. Ozonation prior to GAC filtration lengthens the operating time of GAC filters by 60-65%, when using a reduction of 1 mg/l TOC as a criterion. A dosage higher than 2 mg ozone/l added shows no additional effect. Additional costs of ozonation cannot be covered by cost-savings in reactivation of activated carbon. However, when an AOC limit value is applied as a criterion for the operating time, ozonation prior to GAC filtration results in a significant shortening of the service time of GAC filters. GAC filters remove the mutagenic activity produced by prechlorination and ozonation until 30 000 bed volumes of water have been treated; in this respect, no difference is found between filters receiving ozonated and non-ozonated waters. (Author's abstract)
W85-02019

ULTRAVIOLET DISINFECTION OF WATER,
Katadyn Products, Inc., Wallisellen (Switzerland).
For primary bibliographic entry see Field 5D.
W85-02020

POTENTIAL USE OF ENZYMES AS CATALYSTS IN DRINKING WATER FOR THE OXIDATION OF TASTE CAUSING SUBSTANCES,
Societe Lyonnaise des Eaux et de l'Eclairage, Paris (France).
F. Fiessinger, S. W. Maloney, J. Manem, and J. Mallevialle.
Aqua, No. 2, p 116-118, 1984. 3 Tab, 17 Ref.

Descriptors: *Water treatment, *Enzymes, Drinking water, Purification, Bacteria, Horseradish peroxidase, Taste, Odor, Organic compounds, Chlorphenols, Phenols.

The efficacy of horseradish peroxidase is considered for the removal of 2-chlorophenol (2-CP), a taste and odor compound, and pentachlorophenol (PCP), a wood preservative sometimes found as a contaminant in drinking water. These compounds were evaluated at low as well as high concentrations, and in the presence of potentially competing compounds. In all experiments, the removal was greater than 95% for 2-CP. The enzyme and peroxide concentrations were also varied with no effect on the results. It appears from the study that 100 units/l of horseradish peroxidase and 1 mM peroxide is sufficient for removal of low concentrations of 2-CP. The use of enzymes in drinking water treatment has several advantages over the use of whole bacteria. Enzymes often have high specificities for substrate, so there is better control over the compound removed and the product produced. The enzymes concentration in the water is controlled by the plant operator, thus there is no dependence on the growth rate of the bacteria. Bacteria require an incubation time to acclimatize to the substrate and grow, but enzymes may be added as needs require. (Baker-IVI)
W85-02021

POTABLE WATER TREATMENT IN TROPICAL COUNTRIES: RECENT EXPERIENCES AND SOME TECHNOLOGICAL TRENDS,
Societe Degremont, Rueil-Malmaison (France).
P. Mouchet.
Aqua, No. 3, p 143-164, 1983. 27 Fig, 13 Tab, 34 Ref.

Descriptors: *Water treatment, *Drinking water, *Tropical regions, Potable water, Water quality, Sedimentation, Filtration, Ozonation, Disinfection, Reviews.

Recent examples of the treatment of water problems in tropical countries are cited. While these examples are not exhaustive, they are divided into groups so as to point out the variety of the problems posed. The examples generally refer to surface waters such as lakes, rivers, and impounded waters, but the treatment of underground water is also referred to where applicable. Treatment problems due to the quality of raw waters such as high turbidities, eutrophication in the impounding reservoirs, entailing in particular the treatment of waters containing very large amounts of algae. Toxics naturally present in the water like arsenic or fluorine, and aggressive waters are examined. Most of these problems are due to the fact that under tropical weather conditions, the differences between the dry season and the rainy season are very pronounced. Waters also vary between very low and very high concentrations of minerals. Technical problems encountered are inherent to the size of the plants, the space available, the search for an optimum efficiency, the origin and variability of the waters. Problems are considered from the points of view of clarification, filtration, and ozonization. (Baker-IVI)
W85-02022

CURRENT WATER TREATMENT PRACTICES IN WESTERN INDIA - CASE STUDIES OF TWO METROPOLITAN CITIES, BOMBAY AND AHMEDABAD,
Tata Consulting Engineers, Bombay (India).
A. R. Kanga.
Aqua, No. 3, p 173-177, 1984. 2 Fig.

Descriptors: *Water treatment, *India, *Bombay, *Ahmedabad, Planning, Water management, Drinking water, Water resources development, Water supply development.

As cities grow in size and complexity the operational problems of the systems serving them increase both in scale and in complexity necessitating changes requiring the adoption of an integrated approach and the introduction of new simplified patterns. How this is being achieved currently in two of the largest cites in western India, Bombay and Ahmedabad, is described with particular reference to the problems of water treatment. The plants as described are larger than any other so far installed in the country. Each city started developing its water supplies on entirely different lines, each commencing with the exploitation of local sources. The overwhelming trend in each case has been a move toward simplicity in order to combat the problems which come with complexity. This drive toward simplicity is visible in the Master Plans for each city. Bombay has had to switch over from gravity supply to one largely dependent on pumping. Ahmedabad will have to phase out the tube wells and bores on which it has been so heavily dependent in the past and switch over the surface supplies. Treatment of water is assuming more importance in each city. The size of treatment facilities has also been increasing. These larger plants are vulnerable to situations where the piling up of a back log on washing operations alone can throw the entire plant out of gear. By adopting the system of variable declining rates of filtration such situations involving escalating failures can be much better controlled. In this system when a filter bed gets choked and cannot take its normal burden the load is automatically transferred to other units in the same battery which are in a fresher condition. (Baker-IVI)
W85-02024

COAGULATION AND RESTABILIZATION OF PARTICULATE, MACROMOLECULAR AND PROTECTED ORGANIC AQUASOLS BY ALUMINUM (III),
Ohio State Univ., Columbus. Dept. of Civil Engineering.
A. J. Rubin, and P. R. Schroeder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-207364, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Center Completion Report No. 711522, March, 1984. 104 p, 20 Fig, 5 Tab, 83 Ref. Project No. OWRT A-054-OHIO(1).

Descriptors: *Coagulation, *Colloids, *Aluminum III salts, *Chemical coagulation, *Organic soils, Core, Starch, Mineral oil, *Aggregation, *Aluminum compounds, *Water treatment, Hydrogen ion concentration, Hydrolysis.

Chemical coagulation processes for the removal of particulate organic sols including suspensions of finely-ground coal, starch and mineral oil emusions were studied. The specific objectives of the project were to examine the effects of pH, neutral salts and hydrolyzing aluminum salts on the stability of these organic colloids and to determine the mechanisms by which these aggregants operate. Stability limit diagrams were developed for each system. The principal zone of aggregation for those systems using hydrolyzing aluminum salts was the central sweep zone. For both coal and starch, aggregation in the sweep zone was by enmeshment of the colloid in the floc particles of the aluminum hydroxide precipitate. The aggregation of simple mineral oil emulsions by aluminum sulfate was, for the most part, typical of hydrophobic sols.
W85-02105

LACK OF NEPHROTOXICITY IN THE RAT BY SODIUM CHLORITE, A POSSIBLE BY-PRODUCT OF CHLORINE DIOXIDE DISINFECTION IN DRINKING WATER,
Massachusetts Univ., Amherst. Div. of Public Health.
G. S. Moore, E. J. Calabrese, and A. Forti.
Journal of Environmental Science and Health, Vol. A19, No. 6, p 643-661, 1984. 2 Tab, 34 Ref.

Descriptors: *Sodium chlorite, *Chlorine dioxide, *Drinking water, *Toxicity, Water treatment, Disinfection, Chlorite ion, Sodium.

This study evaluated the nephrotoxic effects of sodium chlorite when administered in the drinking water of male Sprague-Dawley rats. Sodium chlorite was administered for periods of 30, 90, and 180 days and at concentrations of 31.2, 125, and 500 ppm (along with appropriate negative and positive controls). Examination of sections by light microscope revealed no abnormalities in the kidneys of the rats in the chlorite exposure groups. Water consumption, mortality, kidney weight, body weight change, and percent kidney to body weight ratio showed no statistically significant relationship to chlorite ion concentration, although an association was observed between the latter two parameters and sodium concentration of treatment water. (Author's abstract)
W85-02119

DEHALOGENATION OF THREE CHLORINATED HYDROCARBONS: AMINE-ASSISTED VERSUS METAL-CHELATE ASSISTED,
University of South Florida, Tampa. Chemical and Environmental Management Services Center.
K. A. Hewes, and D. F. Martin.
Journal of Environmental Science and Health, Vol. A19, No. 6, p 713-724, 1984. 2 Tab, 12 Ref.

Descriptors: *Dehalogenation, *Chlorinated hydrocarbons, Metal chelates, Amines, Chloroform, Solvents.

Metal chelate compounds of the type M(o-OC6H4CH=NC4H9)2 (M = Ni, Cu, Zn, etc.) participate in the dehalogenation of chloroform in the presence of ethylene diamine or tetramethylenediamine under homogeneous conditions and at elevated temperatures. Both an amine-assisted and a metal-assisted pathway are recognized on the basis of rate expression. In contrast, only an amine-assisted pathway was observed for dichloromethane. Under non-homogeneous conditions, however, i.e., using pure solvent, dehalogenation led to (M(diamine)n)Cl2. The importance of solubility as a driving force is considered as are the implications in the design of agents that will effect dehalogenation of chlorinated methanes. (Author's abstract)
W85-02121

INSTRUMENTATION CONTROL AND AUTOMATION FOR ECCUP TREATMENT WORKS,
B. E. Marsh.
Water Services, Vol. 88, No. 1060, p 224-224, 228, June, 1984. 2 Fig.

Descriptors: *Water treatment, *Filtration, *Computers, Management, Water treatment facilities, Flocculation, Sedimentation.

Eccup filtration works is an operational water treatment works using flocculation, sedimentation and rapid gravity filtration to treat water supplied to approximately half of Leeds, England. The current output is about 80 l/day. The most recent development is a scheme involving the renewal of filter valves and updating of all the associated control equipment. The major benefits obtained by providing a computer system to integrate the operational aspects of the works are to provide a good opportunity for analyzing the complete process, to demonstrate the technical viability of the system, quantify the practical benefits and define the operating methods and skills required at all levels; and to provide facilities for evaluating and demonstrating the performance of the equipment. The SCADA computer system forms the middle tier of the hierarchical computer system in that it receives plant data from various sources. Special applications of the SCADA software with respect to Eccup are discussed. (Baker-IVI)
W85-02131

ASSOCIATION OF METAL TOLERANCE WITH MULTIPLE ANTIBIOTIC RESISTANCE OF BACTERIA ISOLATED FROM DRINKING WATER,
Oregon State Univ., Corvallis. Dept. of Microbiology.
J. J. Calomiris, J. L. Armstrong, and R. J. Seidler.
Applied and Environmental Microbiology, Vol. 27, No. 6, p 1238-1242, June, 1984. 2 Fig, 2 Tab, 26 Ref.

Descriptors: *Drinking water, *Bacteria, *Antibiotic resistance, *Metal tolerance, *Oregon, Copper, Lead, Zinc, Raw water, Aluminum, Tin, Cadmium, Water distribution,.

Bacterial isolates from the drinking water system of an Oregan coastal community were examined to assess the association of metal tolerance with multiple antibiotic resistance. Positive correlations between tolerance to high levels of Cu(2+), Pb(2+), and Zn(2+) and multiple antibiotic resistance were noted among bacteria from distribution waters but not among bacteria from raw waters. Tolerances to higher levels of Al(3+) and Sn(2+) were demonstrated more often by raw water isolates which were not typically multiple antibiotic resistant. A similar incidence of tolerance to Cd(2+) was demonstrated by isolates of both water types and was not associated with multiple antibiotic resistance. These results suggest that simultaneous selection phenomena occurred in distribution water for bacteria which exhibited unique patterns of tolerance to Cu(2+), Pb(2+), and Zn(2+) and antibiotic resistance. (Author's abstract)
W85-02133

DETECTION OF ENTERIC VIRUSES IN TREATED DRINKING WATER,
Texas Univ. Medical School at Houston.
B. H. Keswick, C. P. Gerba, H. L. DuPont, and J. B. Rose.
Applied and Environmental Microbiology, Vol. 27, No. 6, p 1290-1294, June, 1984. 5 Tab, 13 Ref.

Descriptors: *Enteroviruses, *Drinking water, Bacteria, Rotaviruses, Turbidity, Raw water,

Water treatment, Coliforms, Seasonal variation, Turbidity, Clarification, Filtration, Chlorination.

The occurrence of viruses in conventionally treated drinking water derived from a heavily polluted source was evaluated by collecting and analyzing 38 large-volume (65- to 756-liter) samples of water from a 9 cu m/s (205 x 10 to the 6th gallons (776 x 10 to the 6th liters) per day) water treatment plant. Samples of raw, clarified, filtered, and chlorinated finished water were concentrated by using the filter adsorption-elution technique. Of 23 samples of finished water, 19 (83%) contained viruses. None of the nine finished water samples collected during the dry season contained detectable total coliform bacteria. Seven of nine finished water samples collected during the dry season met turbidity, total coliform bacteria, and total residual chlorine standards. Of these, four contained virus. During the dry season the percent removals were 25 to 93% for enteric viruses, 89 to 100% for bacteria, and 81% for turbidity. During the rainy season the percent removals were 0 to 43% for enteric viruses, 80 to 96% for bacteria, and 63% for turbidity. None of the 14 finished water samples collected during the rainy season met turbidity standards, and all contained rotaviruses or enteroviruses. (Author's abstract)
W85-02136

EFFECT OF CHLORINATION ON ANTIBIOTIC RESISTANCE PROFILES OF SEWAGE-RELATED BACTERIA,
Ottawa Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5D.
W85-02139

EFFECT OF NONCOLIFORMS ON COLIFORM DETECTION IN POTABLE GROUNDWATER: IMPROVED RECOVERY WITH AN ANAEROBIC MEMBRANE FILTER TECHNIQUE,
Arizona Univ., Tucson. Dept. of Microbiology and Immunology.
S. G. Franzblau, B. J. Hinnebusch, L. M. Kelley, and N. A. Sinclair.
Applied and Environmental Microbiology, Vol. 48, No. 1, p 142-148, July, 1984. 4 Fig, 6 Tab, 23 Ref.

Descriptors: *Groundwater, *Potable water, *Coliforms, *Bacterial analysis, *Membrane filter, Most probable number test.

A total of 529 well and distribution potable water samples were analyzed for total coliforms by the most-probable-number and membrane filter (MF) techniques. Standard plate count bacteria and MF noncoliform bacteria were also enumerated. Frequency of coliform detection, turbidity in most-probable-number tubes, and extensive overgrowth by noncoliforms on MF filters were directly proportional to standard plate counts. Recovery of coliforms was greatest by the MF method at low (< 100 CFU/ml) standard plate count densities and better by the most-probable-number method (confirming gas and turbid tube) at high (> 500 CFU/ml) standard plate count densities. In the latter case, overgrowth by noncoliforms on MF filters suppressed sheen development and, in turn, masked coliform detection. Of 341 atypical (no sheen) MF colonies verified by parallel inoculation of lauryl sulfate broth and billiant green-bile broth, 156 were aerogenic in the latter medium. Of atypical isolates, 84% were identified as either Citrobacter or Enterobacter species. A 4.3-fold reduction in numbers of overgrown MF filters and an 2.2-fold increase in numbers of coliforms recovered from 127 water samples was accomplished by anaerobic incubation of MF cultures. This anaerobic modification of the standard MF technique significantly reduced overgrowth and enhanced recovery of coliforms from potable groundwater. This technique is simple, cost effective, and suitable for monitoring of untreated ground water common to some small water systems and private water supplies. (Author's abstract)
W85-02140

5G. Water Quality Control

BEACH FECAL COLIFORMS,
Gore and Storrie Ltd., Toronto (Ontario).
For primary bibliographic entry see Field 5B.
W85-01711

MODELING ALGAL BEHAVIOUR IN THE RIVER THAMES,
Institute of Hydrology, Wallingford (England).
P. G. Whitehead, and G. M. Hornberger.
Water Research, Vol. 18, No. 8, p 945-953, 1984. 7 Fig, 2 Tab, 27 Ref.

Descriptors: *Algal growth, *Thames, *England, *Model studies, Sensitivity analysis, Extended Kalman Filter, Mechanistic models, Forecasting, Potable water, Water quality.

Forcasting the movement and growth of algae in river systems is particularly important for operational managers responsible for the distribution and the supply of potable water. Algae affect the taste and smell of water and pose considerable filtration problems at water treatment plants. In a collaborative study with the Thames Water Authority, algal models have been developed for the River Thames. The non-linear process controlling algal growth are examined uaing a generalized senitivity analysis technique and the dominant parameters controlling system behavior are identified. The extended Kalman filter (EKF) is then used to estimate these important parameters. The technique of using generalized sensitivity analysis prior to EKF estimation is suggested as a pragmatic approach to the problem of identifying the subset of physically, chemically or biologically meaningful parameters controlling system behavior in mechanistic models. (Author's abstract)
W85-01720

EVALUATION OF THE VISIBILITY CRITERION OF THE MASSACHUSETTS SANITARY CODE FOR SWIMMING IN NATURAL WATERS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6E.
W85-01800

XXVI CFMT - EXHIBITION OF SCIENTIFIC AND TECHNICAL ACHIEVEMENT OF YOUTH IN THE WATER-MANAGEMENT INDUSTRY,
B. Lidzba.
Wasserwirtschaft-Wassertechnik, Vol. 34, No. 1, p 9-10, January, 1984.

Descriptors: *Water management, *Water quality, Water treatment, Wastewater treatment, Water pollution control, Drinking water, Water supply.

The 1983 Fair of the Masters of Tomorrow (FMT) demonstrated how the young innovators in this East German movement compare favorably to their older colleagues in the water-management industry in increasing worker productivity, intensifying and rationalizing water facilities and reducing manpower, saving energy and materials, utilizing funds better, and raising quality while reducing costs. In 1983, 33.8% of all youth in the water industry participated in the FMT movement. Of innovators in FMT, 74.3% were young people and 53.8% of youth brigades presented exhibits. At the XXVI Central FMT, 56 exhibits were presented in the environmental-protection and water-management area. These presented a business gain of 1.8 million Marks, a 7.7 million-mark return on investment, savings of 20,441 manhours/yr and 1,789 MWh/yr energy, a 338,231 cu m increase in drinking water in the public network, and a 734,414-cu m savings in circulating water. (Gish-IVI)
W85-01875

RESULTS AND EXPERIENCE OF THE GREIZ WATER-SUPPLY DISTRICT IN THE FIELD OF RATIONAL WATER USE (ERGEBNISSE UND ERFAHRUNGEN DES VERSORGUNGSBEREICHS GREIZ BEI DER RATIONELLEN WASSERVERWENDUNG),
For primary bibliographic entry see Field 3D.
W85-01880

WASTEWATER PURIFICATION AS RELATED TO THE STUDY OF A RIVER SYSTEM (ABWASSERREINIGUNG IN VERBINDUNG MIT DER UNTERSUCHUNG EINES FLUSSSYSTEMS),
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
For primary bibliographic entry see Field 5D.
W85-01885

QUALITY ASPECTS OF THE BIESBOSCH RESERVOIRS,
Biesbosch Water Storage Corp. (Netherlands).
G. Oskam.
Aqua, No. 6, p 497-504, 1982. 13 Fig, 7 Tab, 7 Ref.

Descriptors: *Biesbosch Reservoirs, *Netherlands, *Water treatment, *Aeration, *Meuse River, Pretreatment of water, Reservoir operation, Thermal stratification, Ammonia, Chlorination, Heavy metals, Algal growth, Kinetics, Model studies.

The Biesbosch Reservoirs (in The Netherlands) are fed with moderately polluted, highly eutrophic water from the River Meuse. Air injection at the bottom of the reservoirs prevents thermal stratification, as this would cause deterioration of water quality. Reservoir mixing also serves as an efficient algal control measure. Under mixed conditions light plays the role of limiting factor for the growth of algae and this, combined with grazing by zooplankton, keeps algal biomass in the reservoirs at low levels. Self-purification process lead to a striking improvement in water quality during the storage period. The improvement not only relates to 'classical' effects like bacterial oxidation of organic substances and ammonia and the die-off of fecal organisms, but also to removal of inorganic and especially organic micropollutants. Physical processes include settling of heavy metals and evaporation of volatile substances, whereas chemical transformations like hydrolysis and photolysis are responsible for the removal of phtalate esters and polynuclear aromatic hydrocarbons respectively. Pollutant behaviour in the reservoirs can be described by kinetic models. This is applied to the control of the ammonia levels in the reservoirs by selective intake of river water. The model uses Michaelis Menten kinetics for nitrification of ammonia and also considers the equalizing effect of the reservoirs. As a consequence of the low ammonia concentration in the delivered water breakpoint chlorination is not needed any more and the use of chlorine for transport chlorination has been much reduced. (Author's abstract)
W85-01979

GENERAL STRATEGY FOR SECURITY IN WATER SUPPLY,
Compagnie Generale des Eaux, Paris (France).
M. Dutang, and E. Souteyrand.
Aqua, No. 4, p 155-159, 1983. 10 Fig.

Descriptors: *Environmental protection, *Water pollution prevention, *Water quality control, *Water supply systems, *Drinking water, *Paris, *France, Accidents, Water pollution control.

Water suppliers can produce top quality drinking water from polluted resources, but are still threatened by accidental pollution. The first stage in the realization of an overall security strategy in the Paris suburbs was to assess the actual risks by inspecting the industrial facilities upstream of the major plants. The second step focused on acquiring knowledge of the behavior of pollution through simulations with rhodamine B and their integration into a computerized mathematical model allowing for rapid computation of the real impact on plant intakes. The third step, probably the most important, concerned the detection of acute pollution. A highly sophisticated monitoring station upstream ensures enough time to implement safety measures. Two distinct emergency plans have been devised,

one of which is followed depending on the extent of the pollution. An analysis of the optimum management of the production and back up facilities shows that through the use of alternative resources, interconnections, and increased production prior to arrival of detected pollution, two of the three supply areas are absolutely safe against accidental pollution, and projects to guarantee the third (River Seine) are under study. (Author's abstract)
W85-01990

NEW INSTRUMENTATION IN AUTOMATIC WATER QUALITY MONITORING,
National Board of Waters, Helsinki (Finland).
T. Kohonen, and P. Princz.
Aqua, No. 6, p 292-297, 1983. 7 Fig, 10 Ref.

Descriptors: *Automation, *Water quality control, *Monitoring, Ammonia, Total organic carbon.

The widespread use of automatic monitoring of water quality is limited both by the lack of suitable sensors and analyzers for continuous measurement and by the expense and the malfunction sensitivity of highly developed and complete monitoring systems. The new Finnish-built automatic water quality monitoring station and the results of the field tests made in Finland on the Hungarian ammonia and total organic carbon monitoring equipment are described. The developed water monitoring station is the first type in Finland where the measuring probe is placed directly at the site to be measured. This method avoids the changes in quality of the water due to pumping and transfer of the samples. The system consists of a probe unit including the sensors which is submerged into water, and of the central unit connected to the probe with a multicore cable. The system has proved to be very reliable for the control of both river water and waste water treatment processes. The use of this station in different measuring circumstances is very easy because of the modular construction. By using simpler measuring means and cheaper monitoring stations together with the newest monitoring instruments, the usefulness of automatic monitoring can be expanded from the measurement of indicative parameters to total quality parameters within the same costs. (Baker-IVI)
W85-02007

AUTOMATED SENSOR SYSTEMS FOR WATER RESOURCE POLLUTION WARNING AND TREATMENT PROCESS CONTROL,
Sunderland and South Shields Water Co. (England).
For primary bibliographic entry see Field 5F.
W85-02010

ACIDIFIED LAKES: SEDIMENT TREATMENT WITH SODIUM CARBONATE - A REMEDY,
Lund Univ. (Sweden). Limnological Inst.
G. K. Lindmark.
Hydrobiologia, Vol. 92, p 537-547, July, 1982. 10 Fig, 4 Tab, 19 Ref.

Descriptors: *Lake restoration, *Sodium carbonate, *Acidified lakes, Lake sediments, Acidification, Lime, Lye, Phosphorus, Algal growth, Cation exchange, Nutrient transport, Phytoplankton, Hydrogen ion concentration, Lakes.

Until now, additions of lime have been used to restore the buffering capacity of acidified lakes, but an alternative method which is more effective in the treatment of lakes with organogenic sediments has recently been applied in a full-scale experiment. The method, called CONTRACID, is based on the cation exchange properties of lake sediment. A sodium carbonate (soda ash) solution is injected into the sediment (by a harrow), so that the sediment becomes sodium stocked. A reverse exchange occurs during subsequent acidification. Liming has a limited effect on humic lakes, since Ca-humates have a reduced reverse exchange ability and also the lime, which remains undissolved, is rendered inactive. Ionic exchange processes and nutrient transport were studied in water/sediment cores and in situ enclosures after additions of soda ash-, lye- and lime solutions with subsequent re-acidification. Sodium carbonate additions in laboratory systems resulted in a sorption to the sediment of 42-62% of the added sodium ions (5 eq/sq m) and a release of 14-78 mg/sq Pm sediment. Similar results were obtained in the enclosures where phosphorus release stimulated algal growth. Sediment pH, elevated by the sodium base addition, was lowered by re-acidification. Limed systems released no phosphorus and only about 25% of the added lime remained active for future neutralization. With the injection of the sodium carbonate solution into the sediment, only about 12% of the added sodium was recovered in lake water by spring circulation. Lake water alkalinity was then 0.12 meq/l and pH 6.7. Total phosphorus had been raised by 0.007 mg P/l causing an increase in phytoplankton biomass. Observations indicate that manipulations of acidic lake sediment according to the CONTRACID method create a long-lasting neutralizing capacity and a biological stimulation (through phosphorus release), which makes the method an attractive alternative to frequent liming. (Author's abstract)
W85-02096

LAKE TREHORNINGEN RESTORATION PROJECT. CHANGES IN WATER QUALITY AFTER SEDIMENT DREDGING,
National Swedish Environment Protection Board, Uppsala (Sweden). Water Quality Lab.
S.-O. Ryding.
Hydrobiologia, Vol. 92, p 549-558, July, 1982. 5 Fig, 5 Tab, 16 Ref.

Descriptors: *Lake restoration, *Dredging, *Water quality, *Lake Trehorningen, *Sweden, Lake sediments, Macrophytes, Phosphates, Algal growth, Nutrients, Water pollution control, Lakes.

An increased load of domestic wastewater to Lake Trehorningen induced oxygen-poor water conditions and the development of a reduced sulfide-rich sediment layer. Severely polluted, the lake did not recover, even after advanced wasterwater treatment and sewage diversion. Restoration measures with suction dredging and macrophyte elimination were applied in 1975 and 1976. The loose topmost sediment was pumped into an embanked and overgrown bay which was used as a settling pond. The activities also included a restoration of the shorelines. This project is the largest restoration program carried out in Sweden on a single lake, corresponding to a cost of about US $2 000 000. The restoration of Lake Trehorningen was followed by a highly intensive research program which included water chemistry and algal assays. The concentrations of phosphate and total phosphorus decreased by 73 and 50% respectively, as summer average values, two years after the restoration. However, the concentrations of phosphorus are still too high to permit this element to act as a prime algal growth-limiting nutrient. The algal biomass has also remained at the same magnitude as before the restoration. Nitrate-N concentrations showed a tenfold increase, based on average values for the summer period. However, based on the results of the algal assays, a rapid and marked response was obvious, with a drastic decline in the algal growth potential. In addition, the water quality of the tributaries was frequently of an objectionable character (0.1-0.2 g P/cu m). The nutrient loading from these sources exceeds the critical level for the lake, and measures have now been carried out to treat all the inflowing waters for the removal of phosphorus. (Author's abstract)
W85-02097

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

NEW ECOLOGICAL APPROACH TO THE WATER CYCLE: TICKET TO THE FUTURE,
Swedish Natural Science Research Council, Stockholm.
M. Falkenmark.
Ambio, Vol. 13, No. 3, p 152-160, 1984. 8 Fig, 34 Ref.

Descriptors: *Hydrologic cycle, *Water demand, *Water policy, *Planning, *Human population, Resources management, Water management, Water supply, Water shortage, Water scarcity.

Water availability poses definite limits to population development in Northern Africa and the Middle East. Projected population growth will not be possible without a fundamental change in approach to the interaction between water and land. Ecologists will have to start including the water cycle in the ecosystem concept. As gross demands on water multiply with the population, the 'hunger zone' - a wide belt including both arid and humid areas, centered around the equator - will face critical water shortages by the middle of the next century unless far-reaching management schemes are introduced linking together soil and water conservation. The most damaging impacts will develop in Asia and Africa, where the amount of water available on a per capita basis will be reduced from the present (1980) average level of 5100 and 9000 cu m per person per year in Asia and Africa, respectively, to 2600 and 1600 cu m per person per year, respectively. Only through more efficient use of water resources can planners even hope to cope with this shortfall. Under conditions of water scarcity it will be necessary to exchange the technical approach to water with a totally new ecologically based approach. (Collier-IVI)
W85-01704

RATIONALIZATION OF CENTRAL PLANNING IN WATER MANAGEMENT THROUGH THE INTRODUCTION OF EDP (RATIONALIZIERUNG DER ZENTRALEN PLANUNG IN DER WASSERWIRTSCHAFT DURCH EINSATZ DER EDV),
For primary bibliographic entry see Field 7C.
W85-01879

PRACTICAL INTRODUCTION OF THE REMOTE CONTROL SYSTEMS AND PROCESS CONTROL FACILITIES,
Grombach Consulting Engineers, Zurich (Switzerland).
P. Grombach.
Aqua, No. 6, p 285-291, 1983. 6 Fig.

Descriptors: *Remote control, *Water treatment facilities, Monitoring, Computers.

Before rushing into the use of a remote control system, three areas of investigation must be pursued to determine if such a system is necessary. The task of the remote control system or process control facility must be defined as exactly, completely and concretely as possible. Secondly, since the remote control system will generally be introduced into an existing water supply installation which is already controlled in some way, it is necessary to examine in detail the short-comings of the existing monitoring and control system. Thirdly, it is advisable to set a cost limit on the total expenditure for the introduction of the remote control technique and the process control as early as possible. Once these questions are answered, the task must be delineated so that the call for bids can be made. A diagram must be drawn of the whole water supply to be controlled, including all installations. A diagram of the equipment to be installed in the dispatching center must be elaborated. If the scope of supervision and control justifies the installation of a process computer, there are often difficulties in describing the computing program specification. Incoming bids must be evaluated. Preference should be given to the system having the simpler design. (Baker-IVI)
W85-02006

MICRO-ELECTRONICS IN THE WATER INDUSTRY - A REVIEW OF PRESENT AND PROBABLE FUTURE DEVELOPMENTS,
Newcastle and Gateshead Water Co., Newcastle-upon-Tyne (England).
T. R. Atkinson.
Aqua, No. 6, p 298-301, 1983. 9 Ref.

Group 6A—Techniques Of Planning

Descriptors: *Automation, *Water supply, *Management, Computers, Review.

The microprocessor consists of a small central processing unit, complete with an arithmetic unit and memory which can perform logical decisions as required by a list of instructions or programs. Present trends indicate continued development of communication circuits making greater use of optical fibers, microwave transmissions and, in difficult terrain, satellite links. Program packages are being produced to enable users to write and modify systems without the help of software specialists and new types of language such as PROLOG will enable artificial intelligence to be introduced into systems. PROLOG is a conversational language which allows facts and rules to be stored and questioned and is based on logic rather than numeric analysis. (Baker-IVI)
W85-02008

TOWARDS TOTAL AUTOMATION OF WATER DISTRIBUTION (VERS L'AUTOMATISATION INTEGRALE DANS LA DISTRIBUTION D'EAU),
Compagnie Generale des Eaux, Paris (France).
J. Fontaine.
Aqua, No. 6, p 302-312, 1983. 11 Fig, 8 Ref.

Descriptors: *Automation, *Water distribution, *Water management, *Paris, *France, Planning, Computers, Remote control, Monitoring.

A brief outline is offered of the initial uses of electronics in water distribution with particular emphasis on centralized remote control. Industrial electronics and data processing as related to the water distribution industry are considered. Recent advancements have enabled systems to be established which provide better operation of installations, improved economic management, proper statistical management which makes possible sound investment decisions. A description is offered of a complete system now under development for fitting out the water supply installations serving 4 million inhabitants of the Paris suburbs. Three production plants, on the Seine, Marne and Oise rivers, respectively, delivering an average of 900,000 cu m/day of water, 40 pumping stations and 100 reservoirs spread out over the territory of the 14 communities served have been integrated into the automated monitor and management system. (Baker-IVI)
W85-02009

2001 ... THE FUTURE OF WATER TREATMENT (2001 ... L'AVENIR DU TRAITEMENT DE L'EAU),
Compagnie Generale des Eaux, Paris (France).
P. Schulhof.
Aqua, Vol. 1984, No. 2, p 79-85, 1984. 10 Fig.

Descriptors: *Water treatment, Forecasting, Planning, Technology transfer, Data storage and retrieval, Computers, Ozonation, Reverse osmosis.

This research aspires to analyze the lines of force of the current evolution of water treatment technology which has been characterized by a better understanding of the phenomena involved, a mastery of processes, and an increasing complexity of the treatment stages. Integration of processes, use of tertiary reagents, on-line instrumentation, laser, data bank, and computer assisted analysis are some of the technological steps which have characterised the main technical evolution during these last years. Improvements and new developments in ozonation, reverse osmosis, and other treatment processes need to be made before water treatment technology can meet the needs of our immediate future. New methods of measuring water quality have to be widely applied. The great technological revolution in the field of water treatment has not yet occurred but is inevitable. (Wheatley-IVI)
W85-02017

CURRENT WATER TREATMENT PRACTICES IN WESTERN INDIA - CASE STUDIES OF TWO METROPOLITAN CITIES, BOMBAY AND AHMEDABAD,
Tata Consulting Engineers, Bombay (India).
For primary bibliographic entry see Field 5F.
W85-02024

CASE FOR AUTOMATED WATER MANAGEMENT,
P. Millington.
Water Services, Vol. 88, No. 1060, p 219-220, June, 1984. 5 Fig.

Descriptors: *Water management, *Automation, *Control systems, *Water distribution, *Water treatment, *Industrial water, *Pumping plants, England, Wales, Remote control, Monitoring.

The water cycle - from reservoir or river to effluent discharge - is under two masters. The water authority controls extraction, storage, delivery and eventually the effluent reception and treatment. In between is the industrialist who manages or mismanages the water distributed for use within his plant. Philip Millington suggests that neither body does this really efficiently and that there is great scope for educated automation to improve reliability and reduce operating costs. (Author's abstract)
W85-02130

IRRIGATED AGRICULTURAL EXPANSION PLANNING IN DEVELOPING COUNTRIES: RESILIENT SYSTEM DESIGN,
Cairo Univ., Giza (Egypt). Dept. of Irrigation and Hydraulics.
M. N. Allam, and D. H. Marks.
Water Resources Research, Vol. 20, No. 7, p 775-784, July, 1984. 5 Fig, 8 Tab, 15 Ref.

Descriptors: *Irrigation, *Agricultural development, *Developing countries, *Planning, Uncertainties, Economic efficiency, Model studies, Resilient system design.

A multicriteria optimization model is built to determine performance as well as operating rules of an agricultural system under future uncertainties inherent in the planning parameters. Performance of the agricultural systems is measured in terms of the economic efficiency and income redistribution criteria. The operating decisions are determined in such a way that the reduction in performance due to unpleasant surprises in the planning parameters can be minimized. The multicriteria model is used in deriving the relationship between the performance of a case study and the unpleasant changes in the planning parameters. A resiliency index in terms of the gradients of these functional relationships in a probabilistic framework is provided. Based on this resiliency index, a definition of resilient system design is reached. (Author's abstract)
W85-02144

USE OF MODELS FOR WATER RESOURCES MANAGEMENT, PLANNING, AND POLICY,
Office of Technology Assessment, Washington, DC.
R. Friedman, C. Ansell, and S. Diamond.
Water Resources Research, Vol. 20, No.7, p 793-802, July, 1984. 1 Fig, 1 Tab, 11 Ref, 2 Append.

Descriptors: *Water management, *Planning, *Policy, *Model studies, Mathematical models, Institutional constraints, Training.

The Office of Technology Assessment (OTA) of the U.S. Congress investigated the current and potential use of water resource-related mathematical models. It focused on mathematical modeling as a means of assessing the broader issue of the nation's ability to analyze and plan courses of action to deal with current and long-range water problems. OTA found that models capable of analyzing many pressing water resource issues are currently available and that these models have significant potential for increasing the accuracy and effectiveness of information available to managers, decisionmakers and scientists. Surveys and workshops conducted by OTA, however, indicate that institutional constraints to modeling - including inadequate Federal support services for model dissemination, training, and technical assistance, and maintenance - have impeded modeling from realizing its full potential. The states, in particular, are hard pressed to fulfill their present responsibilities without an improved capacity to use the best available analytical tools, which they rely on the federal government, in part, to provide. Many major federal agencies, however, lack an integrated plan for developing and supporting models; in the absence of a comprehensive strategy, federal agencies are often unresponsive to both state and federal problem-solving needs. (Author's abstract)
W85-02146

6B. Evaluation Process

EVALUATION OF FISHERMAN BENEFITS STEMMING FROM SPECIAL USE FISHERY MANAGEMENT PROGRAMS,
Wyoming Water Research Center, Laramie.
M. A. Collins, T. Buchanan, and C. Phillips.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-212364, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, July, 1981. 97 p, 1 Fig, 17 Tab, 31 Ref, 4 Append. Project No. OWRT B-042-WYO(1), Contract/Grant No. 14-34-0001-9161.

Descriptors: *Fish management, *Sport fishing, Recreation demand, *Wyoming, Wild fishery, Trophy fishery.

The major objective of this study was to determine whether waters managed under special wild and trophy management programs were attracting fishermen with interests and preferences consonant with those program objectives. The database for the study was obtained via a combination direct contact and mail questionnaire survey conducted by the Water Resources Research Institute at the University of Wyoming. A total of 1,104 usable questionnaires were received from fishermen sampled at four specially managed waters and two control waters. Both the wild and trophy management programs had been recently implemented, but had not been publicized. A program to publicize the specially managed waters was to have been initiated prior to the study, but problems with the program caused the publicity program to be delayed. In spite of the absence of the planned publicity program, results of the study generally indicate fishermen with wild or trophy interests were being attracted to the appropriate waters. Based on fisherman preferences (preference domains determined by cluster analysis techniques), the wild fish managed waters were attracting fishermen with wild fish interests, and the trophy fish managed waters were attracting fishermen with trophy fish interests as compared to the interests of fishermen contacted at the two control (basic yield) waters. The authors feel the results of the study would have shown a stronger relationship between the specially managed waters and preferences of fishermen using those areas had the planned publicity programs been implemented as scheduled.
W85-01831

FISHABLE WATERS EVERYWHERE: AN APPROPRIATE GOAL,
Texas Tech Univ., Lubbock. Dept. of Civil Engineering.
G. F. Lee, and R. A. Jones.
Industrial Water Engineering, Vol. 20, No. 6, p 14-16, 1983. 5 Ref.

Descriptors: *Water quality control, *Legislation, *Navigable waterways, *Industrial discharge, Fish, Channels, Municipal wastes, Wastewater disposal.

Two types of situations in which the goal of fishable waters everywhere seems inappropriate are considered. One is industrial channels and the other is domestic or certain other wastewater discharges into natural waters. Industrial channels are typically man made or man enhanced watercourses traditionally considered to be among the most polluted waterways in the world. It is questioned whether state pollution control agencies should now require that all contaminants discharged to these waters be controlled to the degree necessary to allow fish and other aquatic life to exist within

them. This was not the intended use and design of these waterways, and there would be some doubt as to the wholesomeness of fish swimming in these waters. With regard to waters in the vicinity of domestic and certain other wastewater discharges, there are two regions of concern: the mixing zone and the zone of potential chronic toxicity. As a public health preventive measure, industrial channels and waters just downstream from municipal and some industrial wastewater discharges should not be made into fishable waters. This can be accomplished by the exclusion of large populations of game fish in these areas which can in turn be done by maintaining low dissolved oxygen in the industrial channels and normal chlorine concentrations in domestic wastewater discharges. (Baker-IVI)
W85-01850

DEVELOPMENT AND FIELD TESTING OF A METHODOLOGY FOR ASSESSING COMMUNITY READINESS FOR SELF-HELP IN THE INSTALLATION, MAINTENANCE AND REPAIR OF WATER SUPPLY AND SANITATION FACILITIES,
Water and Sanitation for Health Project, Arlington, VA.
For primary bibliographic entry see Field 7C.
W85-01980

WATER DECADE (LA DECENNIE DE L'EAU),
Commission of the European Communities, Brussels (Belgium).
P. Peligry.
Aqua, No. 1, p 27-30, 1983. 2 Tab.

Descriptors: *Water supply development, *Sanitation, *Developing countries, *Financing, *European Economic Community, Rural areas, Rural sociology.

Three major groupings of developing world countries are in need of financial aid from the European Economic Community (EEC) to develop water supply and sewerage systems. These groups include the Africa-Caribbean-Pacific (ACP) countries associated with EEC under the terms of the second Lome Convention, the eight countries situated to the south of the Mediterranean basin each of which has a cooperation agreement with the EEC, and the non-associated countries of the rest of the Mediterranean basin, Latin American and the Middle and Far East who meet certain criteria. The important phases which precede financing include the programming phase which is an agreement between the parties on the amount of aid to be available in a particular period and the sectors of development in which it is to be used, and the examination phase in which the parties jointly evaluate a project according to certain criteria. One problem encountered in the area of water supply development and protection has been that the receiving countries themselves are not giving water sufficient priority in the programming phase through lack of knowledge of the needs. Policies for the water sector are not sufficiently elaborated upon and therefore do not stimulate the development of programs. There has been an acceptance in some countries of EEC participation in village water projects which seems the best chance of improving the conditions of life in rural areas where the population may represent up to 80% of national totals. (Baker-IVI)
W85-01984

ECONOMISING WATER AND FIGHTING AGAINST WASTAGE (ECONOMIE D'EAU ET LUTTE CONTRE LE GASPILLAGE),
Lyonnaise des Eaux, Paris (France).
F. Auzias.
Aqua, No. 5, p 215-219, 1983. 2 Fig, 8 Ref.

Descriptors: *Water resources development, *Planning, Management, Water management, Water supply, Water demand.

Increasing concentrations of populations and increasing per capita water consumption have lead to the use of water from resources located at distances further and further away from the area of need as well as the use of water resources which require treatment and thereby additional expenditures of money. Before investigating additional resources, efforts should be made to be certain that the resources already employed are being used to their best capacity. Different stages of water movement from the catchment to the tap should be reviewed including production, conveyance, and distribution. Behavior of the users must also be investigated. The effectiveness of such actions as these may help prevent the investment of time and money in producing new systems. (Baker-IVI)
W85-01996

PLANNING, IMPLEMENTATION OF DIRECTIVES AND PIPELAYING STANDARDS,
Service des Eaux, Services Industriels de Geneve (Switzerland).
R. Pfund.
Aqua, No. 5, p 225-229, 1983. 9 Fig.

Descriptors: *Planning, *Pipelines, *Geneva, Standards, Water mains, Water conveyance, Water distribution, Water demand, Water management.

Planning aspects used in Geneva for the replacement of pipes are detailed. A planned approach is outlined for obtaining information on the condition of the distribution system so that replacement decisions can be made. A review is made of systems in Geneva from before 1950 to the present and developments which have taken place are indicated. The advantages of ductile iron pipes are stressed and practical experience given with some suggestions on the correct method of laying pipes. Ductile iron pipes offer very great resistance to all mechanical stresses to which a water main is often subject. If ductile iron pipes are used the spectacular leakages following burst pipes are no longer possible and serious disturbances to the water supply of the community involved are averted. (Baker-IVI)
W85-01998

MATARA WATER SUPPLY PROJECT IN SRI LANKA,
National Water Supply and Drainage Board, Colombo (Sri Lanka).
For primary bibliographic entry see Field 5F.
W85-02013

QUANTIFYING THE RELATIVE PERFORMANCE OF ALTERNATIVE MEASURES FOR FULFILLING INSTREAM USES IN THE PLAINS ENVIRONMENT,
Kansas State Univ., Manhattan. Dept. of Civil Engineering.
R. L. Smith.
Water Resources Research Institute, Contribution No. 237, June, 1982. 80 p, 12 Fig, 2 Tab, 16 Ref, 2 Append. Project No. OWRT A-103-KAN(1), Contract/Grant No. 14-34-0001-0118.

Descriptors: *Measuring instream use, *Average annual instream use, *Instream use probabilities, *Instream use, Great Plains, *Kansas.

The increasing demand for more formal recognition of instream use poses the need for a methodology which appraises instream service in an objective fashion. Little prior effort has been directed toward this goal. This project makes no attempt to assess a dollar value to instream benefits, but does present a procedure for determining an index of the average annual fulfillment of instream use. The suggested procedure requires the joint integration of fulfillment based on velocity and depth considerations with the percent of time the several velocities and depths are encountered. The percent of time analysis utilizes 'use specific' flow duration curves representative of the portion of the year deemed critical to the specified instream use. Case studies for ten different streams and 19 different record periods are presented. In aggregate, these studies cover a wide range of hydrologic regimes encountered in Kansas. Predictive functions developed in the study are useful in predicting the service to instream use for Kansas streams under natural conditions of flow. Computer programs are provided which allow determination of fulfillment indices for either natural or altered flow conditions. The required input data includes the flow duration curve for the critical season, and depth-velocity-discharge relation for the channel reach.
W85-02107

6D. Water Demand

WATER SUPPLY IN THE FEDERAL REPUBLIC OF GERMANY,
Deutscher Verein des Gas- und Wasserfaches e.V., Eschborn (Germany, F.R.).
W. Merkel.
Aqua, No. 6, p 265-271, 1983. 9 Fig.

Descriptors: *Water supply development, *Water quality control, *West Germany, Water resources, Water demand, Water treatment.

The water supply situation of the Federal Republic of Germany is discussed. A balance sheet of resources against demand is outlined together with a description of present and possible future water quality problems. The secular annual average for total water resources is 161 billion cubic meters, comprising 208 billion cubic meters of precipitation, less 129 billion cubic meters of evaporation, plus 82 billion cubic meters in flow from upstream. Roughly one quarter of the resource is used for cooling water for power stations, for industrial uses, and for water supplies to the domestic and small business industry sectors. A description of water treatment techniques used in the Republic is given along with typical examples. The overriding guideline is that of protection of the water supply being favorable to water treatment. The quality of surface water has shown a marked improvement over the part ten years as a result of increased construction of sewage treatment plants. Types of utilities in existence in the country are described along with their powers and responsibilities. Water management is viewed as a public responsibility. (Baker-IVI)
W85-02002

COMPARISION OF WATER CATCHMENT AND STORAGE SYSTEMS IN TWO MICRONESIAN ATOLL COMMUNITIES: LAURA AND NAMA,
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
R. A. Stephenson, and H. Kurashina.
Water and Energy Res. Inst. of the Western Pacific, Mangilao, Technical Report No. 50, September, 1983. 80 p, 42 Fig, 6 Tab, 19 Ref. Project No. OWRT A-021-GUAM(1), Contract/Grant No. 13-34-0001-0112, 1112.

Descriptors: *Catchment areas, *Water storage, *Social aspects, *Atolls, Water tanks, Water harvesting, Rural areas, Tropical regions, Rainfall, Marshall Islands, Carolinian Islands, Nama Island, Majuro Atoll.

This technical report focuses on; a discussion of freshwater catchment and storage systems in Micronesia. Particular attention is paid to the conditions within two small Micronesian atoll environments, the village of Laura on Majuro atoll in the Marshall Islands and the village community of Nama, a small Carolinian island lying outside of Truck lagoon. Both of the study areas lie within American jurisdication in the western Pacific. Fieldwork at Laura in August 1981 revealed that a paradox exists between the abundant availability of freshwater occurring as rainwater and groundwater on the one hand, and frequent shortage of freshwater on the other. Fieldwork on Nama in August 1982 revealed a similar abundant availability of rainwater, but freshwater shortages were rarely reported. It is suggested that different levels of individual initiative and community response to the need for freshwater are apparent in the two island communities being studied. Particular variables such as access to the district center, availability of construction materials and supplies, community level planning and leadership or lack of the same, and time perspectives may be called upon to help explain variations between the freshwater

catchment and storage systems found at Laura and Nama.
W85-02028

PROJECTED PUBLIC SUPPLY AND RURAL (SELF-SUPPLIED) WATER USE IN FLORIDA THROUGH YEAR 2020,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W85-02036

QUANTIFYING THE RELATIVE PERFORMANCE OF ALTERNATIVE MEASURES FOR FULFILLING INSTREAM USES IN THE PLAINS ENVIRONMENT,
Kansas State Univ., Manhattan. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W85-02107

MANAGING WATER SCARCITY: AN EVALUATION OF INTERREGIONAL TRANSFERS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 6F.
W85-02145

6E. Water Law and Institutions

TORT RECOVERY OF ACID RAIN DAMAGES IN THE UNITED STATES - OBSERVATIONS ON PLAINTIFF'S PRIMA FACIE CASE,
Vermont Law School, South Royalton. Environmental Law Center.
D. R. Honabach.
International Journal of Environmental Studies, Vol. 18, No. 2, p 91-99, 1982. 50 Ref.

Descriptors: *Acid rain, *Judicial decisions, *Damage, *Torts, *Prima facie, Liability, Legal aspects, Decision making, Common law, Air pollution.

An individual acid rain plaintiff in the United States, who would attempt to make a prima facie case in tort to recover damages for harms caused by acid rain must prove that defendant's acid rainmaking activity was a liability-incurring activity; that defendant's acid rainmaking was the proximate cause of harm; and that plaintiff suffered harms of a type for which damages can be recovered. The first two of these problems are the most difficult. Present theories of causation will make it difficult for plaintiff to present adequate proof of cause-in-fact because he must pinpoint the source of the harm. Common law tort doctrine has long supplied a judicially administered vehicle for dealing with harms suffered by one party as a result of the activities of another. As such, it might be used to address the problem of acid rain. Before tort law may be so used, however, a would-be plaintiff must make out a prima facie case. While traditional applications of tort doctrine might effectively prevent plaintiff from doing so, recent court decisions suggest that plaintiff might nevertheless be successful in obtaining at least partial recovery. (Collier-IVI)
W85-01667

ACID RAIN AND FEDERAL COMMON LAW,
Vermont Law School, South Royalton. Environmental Law Center.
J. D. Harper.
International Journal of Environmental Studies, Vol. 18, No. 2, p 101-108, 1982. 32 Ref.

Descriptors: *Acid rain, *Judicial decisions, *Federal common law, Legal aspects, Decision making, Common law, State law, Clean Air Act, Air pollution.

When Illinois v. Milwaukee first came before the Supreme Court in 1972, the court decided, in recognizing the history of federal common law, that federal courts had power to fashion federal common law 'when there is an overriding federal interest in the need for a uniform rule of decision or where the controversy touches basic interests of federalism' 406 U.S. at 105 N.6. When Illinois v. Milwaukee finally reached the Supreme Court again in 1981 after a rather lengthy federal court trial and appeal, the majority, on the basis of statutory amendments passed in the interim, decided that federal clean water legislature amendments preempted or displaced federal common law as that body of law could only be developed by the federal courts where congress had not spoken and occupied the field, and where the varying laws of the states required a uniform federally enunciated principle. The Clean Air Act, which is central to the acid rain dilemma also underwent major restructuring in 1977 and it can be comparatively argued that Illinois v. Milwaukee has inescapable precedent value in the acid rain federal common law Clean Air Act context. If so, the federal forum and uniform rule of law that federal common law gave litigants is no longer available. (Author's abstract)
W85-01668

LEGAL ASPECTS OF ACIDIC PRECIPITATION,
Windsor Univ. (Ontario). Faculty of Law.
J. G. W. Manzig, and J. N. Mulvaney.
International Journal of Environmental Studies, Vol. 18, No. 2, p 117-127, 1982. 1982. 37 Ref.

Descriptors: *Acid rain, *Judicial decisions, *Legal aspects, *Canadian Clean Air Act, *Canada, Decision making, Common law, Clean Air Act, Emission standards, Air pollution.

Acid rain has been discovered to be a serious problem in Eastern Canada. The legislative competence of the Federal Parliament to deal with air pollution is not well established, but recent cases interpreting the federal general power indicate that the scope of general power has been established. Canadian common law remedies are not likely to be successful, for a variety of reasons. The Canadian Clean Air Act, especially with the 1980 amendments lays the basis for possible adoption of emission standards for acid rain as an international pollutant. Ontario's Environmental Protection Act of 1971 may offer a basis for control of emissions resulting in acid rain through regulation of major sources and control orders of medium sized and small sources. One such regulation has already been adopted to apply to the Inco Plant emissions of sulfur oxides. (Author's abstract)
W85-01669

INTERNATIONAL COOPERATION AND ACID RAIN POLLUTION: ESTABLISHING THE FRAMEWORK FOR CONTROL,
Vermont Law School, South Royalton. Environmental Law Center.
F. X. Cameron.
International Journal of Environmental Studies, Vol. 18, No. 2, p 129-134, 1982. 40 Ref.

Descriptors: *Acid rain, *Legal aspects, *International cooperation, International law, Air pollution, Decision making, International agreements.

Acid rain pollution is a classic example of a beneficial economic activity in one nation producing harmful environmental effects in another nation. There has not been a great deal of development in the international legal principles and institutions to address this problem. The international legal principles on State responsibility for environmental damage are still unsettled and substantial procedural and evidentiary obstacles exist to the enforcement of these principles. Regional arrangements that provide a framework for the prevention and control of acid rain offer a promising solution to the problem. An initial step in this regard is the 1979 draft Convention on Long Range Transboundary Air Pollution. The convention calls for the control of air pollution through the exchange of information, research, consultation, and monitoring. The convention is basically concerned with emissions for which it would be difficult to prove damages in any type of judicial or quasi-judicial processing; thus, the emphasis is on prevention. A framework is provided for future action, for more specific agreements on control technologies, emission levels, and liability. (Collier-IVI)
W85-01670

EVALUATION OF THE VISIBILITY CRITERION OF THE MASSACHUSETTS SANITARY CODE FOR SWIMMING IN NATURAL WATERS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
R. R. Noss, and K. Hatfield.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202530, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center Publication No. 146, April 1983. 35 p, 4 Fig, 2 Tab, 40 Ref. Project No. OWRT A-139-MASS(1), Contract/Grant No. 14-34-0001-2123.

Descriptors: Accidents, Drowning, *Economic justification, *Evaluation, *Institutional constraints, *Safety, *Swimming, Economic evaluation, Liability, Planning, Public acccess, Recreation, Recreation demand, Recreation facilities, Regulations, Sediment concentration, *Massachusetts, *Standards.

The Massachusetts Environmental Code contains a four-foot visibility requirement for waters designated for primary contact use. This standard may be limiting state, public, and private efforts to expand recreational swimming in the State of Massachusetts. The origins of and the rationale behind the visibility criterion are discerned with an explanation of the motivation for adoption of the requirement. Literature on the factors affecting water safety (including water clarity) is reviewed. However, no quantitative verification of the water safety-water clarity relationship has been presented. Lakes and ponds with and without authorized swimming are compared with regard to their clarity and in terms of the expected percentage failing to meet the visibility criterion. Economic considerations associated with existing and alternative criteria are discussed. The costs connected with any visibility criterion (short of eliminating the existing criterion) cannot be justified on the basis of improved water safety alone.
W85-01800

MAJOR INSTITUTIONAL ARRANGEMENTS AFFECTING GROUND WATER IN NEW YORK STATE,
Cornell Univ., Ithaca, NY. Dept. of City and Regional Planning.
R. S. Booth, and A. Bronson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202506, Price codes: A07 in paper copy, A01 in microfiche. Center for Environmental Research Completion Report, December 1983. 125 p, 1 Fig, 70 Ref. Project No. OWRT A-097-NY(1), Contract/Grant No. 14-34-0001-2134.

Descriptors: *Groundwater, *Institutional arrangements, *Regulations, *Government policy, Legal authority, *Institutional constraints, *New York, State regulations.

New York State faces a series of problems respecting both the use and quality of its ground water resources. Portions of its population rely extensively on ground water as a source of water supply. The State is heavily populated, has a substantial industrial base, and has a significant agricultural industry. Each of these factors contributes to the growing seriousness of problems in protecting ground water resources for future use. The major institutional arrangements in New York State relating to management of ground water resources are analyzed in terms of use and quality. Part I outlines the objectives and discusses the project's strengths and limitations. Part II provides a brief overview of the nature of ground water resources in New York State, the current use of those resources, and the current concerns about the quality and use of ground water resources. Part III reviews the major, formal institutional/legal arrangements New York State and the federal government have created for managing the quality and use of ground

water. Part IV summarizes the responses to a survey of county and district health offices, and part V summarizes a similar survey of regional offices of NYS Dept. of Environmental Conservation. Part VI lists the interviews conducted. Part VII states the results from the interviews. Part VIII provides an assessment of the information presented. Part IX states a series of major conclusions.
W85-01802

STATE LAWS MANDATING WATER CONSERVATION,
Maryland Univ., College Park. Dept. of Geography.
S. W. Sawyer, and A. B. Eney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-190404, Price codes: A03 in paper copy, A01 in microfiche. Maryland Water Resources Research Center, College Park, Publication No. 80, August, 1983. 20 p, 1 Tab, 6 Ref, 1 Append. Project No. OWRT A-066-MD(1), Contract/Grant No. 14-34-0001-2122.

Descriptors: *Water conservation, Water supply systems, Leakage, Water loss, *Legal aspects, Water law, *Maryland, State jurisdiction, *State water laws, State regulations.

States have the potential to play a major role in moving water conservation from conferences and reports that identify its advantages to actual practice. The states' regulatory, financial, and educational responsibilities make them especially effective in furthering conservation among public supply systems where various constraints and pressures discourage local initiatives. This research determined the extent and nature of the states' current efforts to further water conservation among these municipal supply systems. Arizona, California, Massachusetts, and New Jersey have multifaceted programs involving conservation plumbing codes, distribution of conservation devices, equipment loan and grant programs to aid leak detection, grants for system rehabilitation and conservation actions, and active information/education outreach programs for schools, the media, and specific user groups. Approximately 11 other states also have two or more of these programs. The study identified consistent concern for water conservation among water supply planners, but found that state initiatives are severely restricted by a lack of political and financial support.
W85-01806

FISHABLE WATERS EVERYWHERE: AN APPROPRIATE GOAL,
Texas Tech Univ., Lubbock. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W85-01850

TASKS OF THE DAM KEEPER (LES TACHES DU GARDIEN DE BARRAGE),
Bureau d'Ingenieurs-Conseils, Lausanne (Switzerland).
For primary bibliographic entry see Field 4A.
W85-01859

6F. Nonstructural Alternatives

FLOOD ELEVATIONS FOR THE SOLEDUCK RIVER AT SOL DUC HOT SPRINGS, CLALLAM COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W85-01773

TRAINING PROGRAMMES IN FEDERAL SYSTEMS OF GOVERNMENT,
National Water Council, London (England).
W. D. Hughes.
Aqua, No. 3, p 117-119, 1983. 1 Fig.

Descriptors: *Water management, *Training, *Education, *Water supply development, *Government supports, Management, Operation, Developing countries.

In order for developing water systems to be effectively maintained, some degree of training at the local level is necessary. Who is to do the training and who is responsible for seeing that it is carried out are two of the major issues facing water supply development success in various parts of the world. Training, while natural to progress, does not necessarily become naturally organized and therefore the impetus provided by federal or state government is needed to bring control to the scene. A decision must be taken over fundamental issues concerning financing and whether an existing organization or a new one should be specially created and charged with the responsibility for regional if not national training. Managers must be committed to training and need to be helped to understand the significance of maintaining training systems. Analysis of training needs, existing facilities and availability of outside help should be undertaken and a careful assessment made of the most efficient and economic manner in which to progress. A small core of specialist trainers, technically qualified, is of great help to maintain impetus. Good training results from a blend of national effort, local effort and the cooperation of the education service. (Baker-IVI)
W85-01989

MANAGING WATER SCARCITY: AN EVALUATION OF INTERREGIONAL TRANSFERS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
H. J. Vaux, Jr., and R. E. Howitt.
Water Resources Research, Vol. 20, No. 7, p 785-792, July, 1984. 1 Fig, 5 Tab, 25 Ref.

Descriptors: *Interbasin transfers, *California, *Water management, Water supply, Water demand, Groundwater recession, Model studies, Economic aspects, Water rights, Market economy.

An interregional trade model is developed for assessing the potential of limited market institutions to alleviate water scarcity. The model differs from those of Takayama and Judge, since curvilinear demand functions are employed and an unequal number of supply and demand regions are specified. The model is applied to California using regional supply and demand functions estimated for 1980, 1995, and 2020. The results show that water transfers can be substituted for new supplies to the extent that less than 100,000 ac ft (123000000 cu m) of new capacity could be justified by 2020. The net benefits to buyers and sellers total $66 million for 1980 and rise to $219 million by 2020. The work also demonstrates that trade would lead to premature drawdown of groundwater resources in the absence of management and might create excess supply capacity for urban regions. (Author's abstract)
W85-02145

6G. Ecologic Impact Of Water Development

SOME ECOLOGICAL CONSEQUENCES OF A PROJECTED DEEP RESERVOIR IN THE KABALEBO RIVER IN SURINAME,
Waterloopkundig Lab., Delft (Netherlands).
J. A. Van Pagee, S. Groot, R. Klomp, and J. H. G. Verhagen.
Hydrobiological Bulletin, Vol. 16, No. 2-3, p 241-254, December, 1982. 8 Fig, 13 Ref.

Descriptors: *Water resources development, *Environmental effects, *Reservoirs, *Devis Reservoir, *Kabalebo River, *Surinam, Water quality control, Rain forests, Oxygen, Mathematical models.

An overview is offered of some water quality aspects related to the construction and operation of the projected Devis Reservoir in the Kabalebo River. The construction of a deep reservoir for hydropower generation and the consequent inundation of a tropical rain forest will drastically disturb the ecological equilibrium in the Kabalebo River basin. Mathematical modelling techniques are used to predict the water quality in the new Devis Reservoir and the adjacent downstream river. Special attention is given to the oxygen budget as the most critical factor in water quality during the first decennium after the start of filling. In order to minimize the ecological impacts of the reservoir construction, an alternative intake design and a delayed filling period are the most promising remedial measures. (Baker-IVI)
W85-01764

CHANGES IN THE FISH FAUNA OF THE FORMER GREVELINGEN ESTUARY, BEFORE AND AFTER THE CLOSURE IN 1971,
G. Doornbos.
Hydrobiological Bulletin, Vol. 16, No. 2, p 279-283, December, 1982. 2 Fig, 2 Tab, 8 Ref.

Descriptors: *Water resources development, *Environmental effects, *Grevelingen Estuary, *Netherlands, *Fish, Aquatic life, Delta plan, Species diversity, Food chains.

Within the scope of the Delta Plan, a number of estuaries in southwestern Netherlands has been closed off. Subsequent changes in the fish fauna in the Grevelingen Estuary are studied. After the closure in 1971 the number of fish species caught declined from 31 to 18, a number which then stabilized by 1978 at 20. When the connection with the North Sea had been renewed for over a whole year, the number of species increased to 26. Before 1971 the Shannon-Weaver index was high, declining in 1972 after the damming was complete. After the closure, the number of small pelagic fish increased enormously. Not only have the number of species and the number of individuals changed over the course of time, but the biomass ratios of the demersal species have also changed. The composition of the fish fauna has drastically changed from larger to smaller species, the diversity has decreased and food chains have become shorter. (Baker-IVI)
W85-01765

BREEDING MALLARD (ANAS PLATYRHYNCHOS) HABITAT SUITABILITY MODEL,
Washington State Univ., Pullman. Dept. of Agricultural Economics.
S. C. Matulich, and J. E. Hanson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202555, Price codes: A05 in paper copy, A01 in microfiche. Washington Water Research Center Report 54, November 1983. 67 p, 23 Fig, 61 Ref. Project No. OWRT B-086-WASH(3), Contract/Grant No. 14-34-0001-9160.

Descriptors: *Habitat suitability index, *Wildlife management, *Mallard, Environmental effects, *Washington, Model studies, Literature reviews, Columbia Basin Irrigation Project.

A habitat suitability index (HSI) model is developed for breeding mallards (Anas platyrhynchos). The HSI model framework follows the Habitat Evaluation Procedures (HEP) developed by the U.S. Fish and Wildlife Service. Overall habitat suitability is defined in terms of nesting and brood-rearing life requisites, and the environmental attributes that quantify each cover type's potential for satisfying the breeding season life requisites. A review of literature on breeding mallard habitat requirements is presented, followed by a generic breeding mallard HSI model. This general model is then modified to account for habitat characteristics in the East High area of the Columbia Basin Irrigation Project, Washington.
W85-01792

TROPHIC ECOLOGY OF FISH REARING PONDS,
Ohio State Univ., Columbus. Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W85-01833

TRAVELING SCREENS AS SAMPLING GEAR FOR VERTICAL DISTRIBUTION STUDIES,
North Carolina State Univ. at Raleigh. Dept. of Zoology.
For primary bibliographic entry see Field 7B.
W85-01842

MAN-MADE STRUCTURES ON MARINE SEDIMENTS: EFFECTS ON ADJACENT BENTHIC COMMUNITIES,
Scripps Institution of Oceanography, La Jolla, CA.
N. Davis, G. R. VanBlaricom, and P. K. Dayton.
Marine Biology, Vol. 70, No. 3, p 295-303, 1982. 4 Fig, 3 Tab, 34 Ref.

Descriptors: *Benthic environment, *Marine sediments, *Structures, *Environmental effects, *San Diego County, *California, Scour, Sedimentary structures, Fish, Polychaetes, Benthic fauna, Sea pens, Oil platforms, Pilings, Coastal waters, Particle size.

This study (1975-1977) examines the effect of man-made structures on natural sand bottom communities in shallow water in San Diego County, southern California, USA. While there were shallow scour effects to 15 m around some artificial reefs, the reefs had no measurable effect on sand ripple patterns, grain size, organic carbon or infauna beyond the scoured areas. Foraging by reef-associated fishes produced profound alterations in the epifauna populations of the sea pen Stylatula elongata. The sea pen densities were 4 to 10/sq m before the reefs wer established, but within 5 mo were eliminated from distances greater than 200 m around the reefs. On the other hand, densities of the tube-building polychaetes Diopatra spp. seemed to be enhanced in the immediate vicinity of the artificial reef. Oil platforms and bridge pilings seem to have much more profound effects on the nearby sand communities than do the relatively small artificial reefs. In addition to the elimination of sea pens, Diopatra spp. densities increased from < 1.0/sq m in control areas to as many as 73/sq m in the vicinity of oil platforms. Grain size and infauna were strongly affected by the oil platform. (Author's abstract)
W85-01895

COMMENTARY ON ENVIRONMENTAL IMPACT ASSESSMENT FOR LARGE PROJECTS AFFECTING LAKES AND STREAMS,
British Columbia Univ., Vancouver. Inst. of Animal Resource Ecology.
P. A. Larkin.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 7, p 1121-1127, 1984. 17 Ref.

Descriptors: *Environmental impact statement, *Lakes, *Streams, Water resources development, Planning, Environmental effects.

Environmental impact assessment is examined as it relates to major projects which will have an influence on aquatic environments in Canada. The purpose of the environmental impact assessment is to guard the public interest in the proper use of resources in the aggregate. Although compromises are usually worked out on a local basis for each project, more widely conceived trade-offs are favored. Frequently environmental impact assessments appear to be mere reflections of projects that are going to materialize anyway. It would be preferred if the assessments were to reflect the pattern of activity through the various stages of a project from conception, through modification and into the final stages. The need for follow up on projects underway is emphasized. It is also important to anticipate some impacts which may not be easily foreseen as likely, and include possible means for making appropriate financial provisions should these unlikely events actually occur. Assessment of potential impacts should no longer be seen as a substitute for research that would lead to new understandings of ecological systems but rather should be increasing in its contribution to the field of environmental research. (Baker-IVI)
W85-01920

CHANGES IN THE NAIAD FAUNA OF THE CUMBERLAND RIVER BELOW LAKE CUMBERLAND IN CENTRAL KENTUCKY,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
A. C. Miller, L. Rhones, and R. Tippit.
Nautilus, Vol. 98, No.3, p 107-110, July, 1984. 2 Fig, 9 Ref.

Descriptors: *Environmental effects, *Water resources development, *Dam effects, *Mussels, *Cumberland River, *Kentucky, Wolf Creek Dam, Clams, Mollusks.

A survey for live mussels was conducted below Wolf Creek Dam, miles 460.8 to 393.2 on the Cumberland River, Kentucky, in October of 1982 to determine if mussel recruitment had taken place following completion of the dam in 1952. Two live mussels were collected, the Spectacle Case and the Purple Pimpleback, found at miles 409.5 and 403.4, respectively. These mussels were lying on, not buried in, the substrate in water that was 50 cm deep or less. The umbones on the latter were deeply eroded and the periostracum on the former were heavily worn, indicating the erosive action of turbulent water in the river. The Asian Clam was the only other live bivalve collected during the study. Turbulent water, fluctuating water levels, and temperatures which remain below 20 degrees C throughout the year are not conducive to mussel recruitment in this area. When the dam was completed, unionid recruitment essentially ceased and existing mussels were gradually lost because of adverse conditions, predation, or natural mortality. (Baker-IVI)
W85-01921

LAND USE EFFECTS ON SEDIMENT YIELD AND QUALITY,
British Columbia Univ., Vancouver. Dept. of Geography.
O. Slaymaker.
Hydrobiologia Vol. 91, p 93-100, July, 1982. 13 Fig, 4 Tab, 68 Ref.

Descriptors: *Sediment yield, *Water quality, *Land use, Sediment transport, Model studies, Environmental effects.

Attempts to establish land use effects on sediment yield and water quality require consideration of background biogeochemical cycling, quantitative land use mapping, selection of appropriate transport and attenuation models, and the assessment of critical or threshold amounts and types of land use change. Progress in each of these problem areas is reviewed. Specifics considered include the defining of the nature of the processes and the rates of transformations in the biogeochemical cycle in the absence of land use change; defining land use categories and changes in sufficiently specific and, where possible, quantitative ways so that the resulting levels achievable in this measurement are compatible with those of land use measurements; define the most appropriate transport and attenuation models which describe the movement of water, sediment, ions, and pollutants through a basin; and defining the criteria by which critical thresholds of land use change can be recognized. (Baker-IVI)
W85-02060

7. RESOURCES DATA

7A. Network Design

DATA BANK FOR WATERWORKS AND FACILITIES - GOALS AND PROBLEM-SOLVING CONCEPT (DATENBANK WASSERWERKE UND ANLAGEN - AUFGABEN UND LOSUNGSKONZEPTION),
Institut fuer Wasserwirtschaft, Berlin (German D.R.).
For primary bibliographic entry see Field 5F.
W85-01969

7B. Data Acquisition

SATELLITE-TRACKED CURRENT DRIFTERS IN LAKE MICHIGAN,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
R. L. Pickett, J. E. Campbell, A. H. Clites, and R. M. Partridge.
Journal of Great Lakes Research, Vol. 9, No. 1, p 106-108, 1983. 2 Fig, 4 Ref.

Descriptors: *Satellite technology, *Lake Michigan, Water circulation, Remote sensing, Lakes.

Satellite-tracked current drifters were tested for use in monitoring near-surface currents in Lake Michigan. Each unit consists of a surface float containing the transmitter and batteries, and a 1-m length of line down to a weighted 1 x 4 m parachute. Satellite-determined positions of the drifters were found to be within 0.5 km. Positions were obtained every two hr. Four drifters were placed on a transect halfway across southern Lake Michigan and tracked. The median current speed determined from the drifters was 17 cm/s. The path lengths over the first two months ranged from 400 to 700 km. The drifters appear to be ideal for monitoring nearsurface lake currents and testing hydrodynamic lake models. (Moore-IVI)
W85-01760

INSTRUMENTATION USED FOR HYDRAULIC TESTING OF POTENTIAL WATER-BEARING FORMATIONS AT THE WASTE ISOLATION PILOT PLANT SITE IN SOUTHEASTERN, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
J. A. Basler.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-file Report 83-144, 1983. 29 p, 16 Fig, 6 Ref.

Descriptors: *Aquifer tests, *Transmissivity, *Test wells, Data logger, Strip chart recorder, Amplifier, Pressure transmitter, Dead weight tester, Inflatable packers, Barometer bailing test, Waste Isolation Pilot Plant, *New Mexico, Eddy County.

Requirements for testing hydrologic test wells at the proposed Waste Isolation Pilot Plant near Carlsbad, New Mexico, necessitated the use of inflatable formation packers and pressure transducers. Observations during drilling and initial development indicated small formation yields which would require considerable test times by conventional open-casing methods. A pressure-monitoring system was assembled for performance evaluation utilizing commercially available components. Formation pressures were monitored with a downhole strain-gage transducer. An inflatable packer equipped with a 1/4-inch-diameter steel tube extending through the inflation element permitted sensing formation pressures in isolated test zones. Surface components of the monitoring system provided AC transducer excitation, signal conditioning for recording directly in engineering units, and both analog and digital recording. Continuous surface monitoring of formation pressures provided a means of determining test status and projecting completion times during any phase of testing. Maximum portability was afforded by battery operation with all surface components mounted in a small self-contained trailer. (USGS)
W85-01827

TRAVELING SCREENS AS SAMPLING GEAR FOR VERTICAL DISTRIBUTION STUDIES,
North Carolina State Univ. at Raleigh. Dept. of Zoology.
R. A. Rulifson, and B. J. Copeland.
Estuaries, Vol. 5, No. 2, p 82-94, June, 1982. 11 Fig, 9 Ref.

Descriptors: *Traveling screens, *Impingment, *Sampling, *Vertical distribution, Intakes, Diurnal variation, Powerplants, Aquatic life, Screens.

A sampling technique has been developed for increasing the information gathered during routine monitoring of impingement at water intake structures. Samples from impingement catches on traveling screens were taken from the sluiceway of the Brunswick Steam Electric Plant near Southport, North Carolina during the screen wash process so as to divide the catch into vertical catch components. Each component represented 1.2 m of the water column. Results showed differences in day and night vertical distributions of impinged organisms according to the spatial preferences of each species. Impingement during daytime was lower than during night. Impingement of surface-oriented species during daytime occurred at mid-depth, midwater species near the bottom, and bottom species were seldom impinged. During the night surface-oriented species were impinged at the surface, midwater species at mid-depth, and bottom species near the bottom. Residue (animals and debris) which remained within the screen wash system from collection of the previous sample, and those organisms which became impinged on the screens during retrieval of the sample, were used to calculate the rate of 'continuous impingement' on the traveling screens. These rates were compared to the impingement catch in order to determine biases in the vertical catch components. Comparison of these rates indicated that impingement estimates determined by routine monitoring methods may underestimate true impingement rates for certain species. This sampling technique for monitoring impingement at intake structures will increase knowledge of the local biologic system while minimizing the cost of obtaining the information. The technique will also aid in pinpointing specific impingement problems which may be corrected through modifications to the design of the intake structure. (Author's abstract)
W85-01842

APPLICATION OF REMOTE-SENSING TECHNIQUES TO HYDROLOGIC STUDIES IN SELECTED COAL-MINED AREAS OF SOUTHEASTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 5B.
W85-01947

SINGLET OXYGEN IN SURFACE WATERS - PART I: FURFURYL ALCOHOL AS A TRAPPING AGENT,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
For primary bibliographic entry see Field 2K.
W85-01964

SINGLET OXYGEN IN SURFACE WATERS - PART II: QUANTUM YIELDS OF ITS PRODUCTION BY SOME NATURAL HUMIC MATERIALS AS A FUNCTION OF WAVELENGTH,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
For primary bibliographic entry see Field 2K.
W85-01965

AUTOMATED WATER LABORATORY - WHAT BENEFIT TO THE CONSUMER,
Wessex Water Authority, Bristol (England). Bristol Avon Div.
J. G. Jones.
Aqua, No. 6, p 321-331, 1983. 12 Fig, 3 Tab, 5 Ref.

Descriptors: *Automation, *Laboratory equipment, *Laboratories, *England, Drinking water, Monitoring, Water quality management,.

For a very long time it has been claimed that the purity of potable water in the United Kingdom is second to none - a very subjective statement, which tends to have been born out by the lack of instances of widespread outbreaks of waterborne disease. In recent years attempts have been made to legislate on the chemical and bacterial quality of both treated drinking waters and the raw waters from which these were derived through EEC Directives. It has been the long standing practice in the UK to adopt the WHO and European Standards for chemical quality and Report 71 recommendations for both frequency of monitoring and bacterial quality. Much dependence is placed on the sample of water that is taken for analysis, and on the data that the laboratory produces. The scientific implications of the results are again crucial along with any course of remedial action that may be necessary to overcome a deficiency in the sample. In turn these data have to be transmitted to field staff, during working hours - perhaps to change a treatment process or to undertake a flushing operation of the distribution system. It is interesting to reflect on what action can be taken, say on a failed bacteriological sample, outside normal laboratory working hours, bearing in mind that traditional bacteriological analysis takes at least 18 hours to produce a result. It has long been the quest of the water scientist to produce the necessary analytical data as quickly as possible in order to minimize the risk of unsatisfactory potable water being passed into the distribution systems. Recent advances in computers and analytical instrumentation have enabled the quest to be brought nearer to reality. This paper outlines the work that has been carried out by Wessex Water in an attempt to achieve that goal. (Author's abstract)
W85-02011

ALTITUDE OF THE TOP OF THE MATAWAN GROUP-MAGOTHY FORMATION, SUFFOLK COUNTRY, LONG ISLAND, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
R. K. Krulikas, E. J. Koszalka, and T. P. Doriski.
USGS Open File Report 83-137, 1983. 1 Map, 1 Fig, 9 Ref.

Descriptors: Areal hydrogeology, *Aquifer systems, Geohydrologic units, *Maps, Magothy aquifer, Suffolk Country, *New York.

The Magothy aquifer, with its irregular surface and deeply eroded buried valleys, has become the major source of fresh water in most of Suffolk Country. With the availability of recent data from deep wells and test holes, refinement of the surface-altitude contours has been possible and resulted in substantial revision in some areas. This 1-sheet map delineates the surface altitude of the Magothy aquifer (Matawan Group-Magothy Formation) and includes a brief text and bibliography. (USGS).
W85-02030

EVALUATION OF ELECTRODE METHODS FOR DETERMINING TOTAL RESIDUAL CHLORINE IN VARIOUS WATER MATRICES,
Benedict Coll., Columbia, SC. Dept. of Chemistry.
J. T. Kinard, F. Jackson, and C. Stackhouse.
Journal of Environmental Science and Health, Vol. A19, No. 6, p 735-755, 1984. 7 Tab, 5 Fig, 19 Ref.

Descriptors: *Electrodes, *Industrial wastewater, *Residual chlorine, Titration, Chlorine, Pollutant identification, Drinking water, Potable water, River water.

Five electrode systems and procedures that are widely marketed for routine determination of total residual chlorine have been evaluated in a variety of water matices. The performance, in terms of accuracy, precision, and sensitivity, has been determined for the Orion 97-70 Residual Chlorine Electrode, Chlortect Monitor, Lazar 136A Chlorine Electrode, the forward amperometric titration method, and the back amperometric titration method. Response times for the former two systems were comparable and ranged for 20-100 seconds for chlorine concentrations ranging from 0.3-7 ppm in all water matrices. The Lazar electrode had considerably longer response times. The Chlortect Monitor and the forward amperometric titration method gave the highest sensitivity with values of plus or minus 0.005 and 0.01 ppm, respectively, at the 1 ppm level. However, the Lazar Electrode could not be completely evaluated because of inconsistencies in the marketed procedures. (Author's abstract)
W85-02123

MICROWAVE MEASUREMENTS OF MOISTURE DISTRIBUTIONS IN THE UPPER SOIL PROFILE,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W85-02160

7C. Evaluation, Processing and Publication

EVOLVING DATA PROCESSING ENVIRONMENT FOR COMPUTATIONAL HYDRAULICS SYSTEMS,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
W. James, and A. Unal.
Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 187-195, June, 1984. 25 Ref.

Descriptors: *Data processing, *Hydraulics, *Hydrologic data, *Hydrology, Computers, Fortran, Data aquisition, Automation, Meteorology, Fluid mechanics, Model studies, Data base management, Local area networks, Continuous modelling, Time series analysis.

Inevitably, distributed data processing will evolve using multi-microcomputer-based data management systems for civil engineering computational hydraulics and hydrology. Research and development groups will adopt networked data management systems including 500K-byte 16-bit and 64K-byte 8-bit microcomputers, FORTRAN as the high level language, and a 60 megabyte central hard disc with boss microcomputer using UNIX-type operating systems. Applications include: data acquisition, management, archiving, and presentation; application programs in areas such as meteorology, hydrology, hydraulics, water quality modelling, fluid mechanics, and coastal and ocean engineering; program maintenance and support; documentation and text processing; and real-time control. Hardware and software systems are undergoing rapid development in all these areas. Emerging techniques make it possible to supplant event modelling, and its associated design storm methodology, with more rational continuous modelling, using archived data, statistical processing of output, and graphics input/output. Continuous modelling, however, leads to data management difficulties. Special software for time series management is essential. Sophisticated data base management systems and local area networks permit improved cost performance for concurrent process control and modelling. Each desk-top computer would be individually assigned hydrological modules, communicating with a central hard disk boss microcomputer. (Collier-IVI)
W85-01709

PREDICTING VARIABILITY IN A LAKE ONTARIO PHOSPHOROUS MODEL,
Michigan State Univ., East Lansing. Dept. of Resource Development.
For primary bibliographic entry see Field 2H.
W85-01758

QUALITY-ASSURANCE DATA FOR ROUTINE WATER ANALYSIS IN THE LABORATORIES OF THE U.S. GEOLOGICAL SURVEY FOR WATER-YEAR 1982,
Geological Survey, Denver, CO. Water Resources Div.
D. B. Peart, and N. A. Thomas.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4264, 1983. 112 p, 180 Fig, 6 Tab, 7 Ref.

Descriptors: Alkalinity, *Chemical analysis, Dissolved solids, Heavy metals, Laboratories, Probability distribution, Quality control, Specific conductivity, Statistics, Trace elements, Trace metals,

*Water analysis, *Quality assurance, *Data collections.

The U.S. Geological Survey maintains a quality-assurance program based on the analysis of reference samples for its two water-analysis laboratories located in Atlanta, Georgia, and Denver, Colorado. Reference samples containing inorganic constituents are prepared at the U.S. Geological Survey's Ocala, Florida, office and disguised as routine samples, and sent daily to each laboratory through other U.S. Geological Survey offices. The results are permanently stored in the National Water Data Storage and Retrieval System (WATSTORE), the U.S. Geological Survey's data base for all water data. These data are analyzed statistically for precision and bias. The results of these statistical analyses are presented for data collected during the 1982 water year. In addition, one sample containing known concentrations of trihalomethanes was analyzed in both laboratories, and these results also are presented. (USGS)
W85-01768

TRUE LOCATION AND ORIENTATION OF FRACTURES LOGGED WITH THE ACOUSTIC TELEVIEWER (INCLUDING PROGRAMS TO CORRECT FRACTURE ORIENTATION),
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01780

REGIONAL GEOHYDROLOGY OF THE NORTHERN LOUISIANA SALT-DOME BASIN, PART III, POTENTIOMETRIC LEVELS OF THE WILCOX-CARRIZO AND SPARTA AQUIFERS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01785

COMPUTER PROGRAM AND DATA LISTING FOR TWO-DIMENSIONAL GROUND-WATER MODEL FOR LARAMIE COUNTY, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. A. Crist.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4137, 1983. 137 p, 3 Tab, 3 Ref.

Descriptors: *Computer programs, Fortran, Simulation, *Wyoming, Laramie County, *Model studies, Data collections, *Groundwater flow, Hydrologic conditions, *Two-dimensional model.

This is a supplement to the report, 'Effect of pumpage on ground-water levels as modeled in Laramie County, Wyoming,' published as U.S. Geological Survey Water-Resources Investigations Open-File Report 80-1104. The computer program and data used to model ground-water conditions in post-Cretaceous rocks in Laramie County are listed. (USGS)
W85-01787

MACHINE-READABLE DATA FILES FROM THE MADISON LIMESTONE AND NORTHERN GREAT PLAINS REGIONAL AQUIFER SYSTEM ANALYSIS PROJECTS, MONTANA, NEBRASKA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING,
Geological Survey, Denver, CO. Water Resources Div.
J. S. Downey.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 82-4107, 1982. 26 p, 10 Fig, 4 Tab, 11 Ref.

Descriptors: *Water levels, Head data, Basic data, Geologic data, *Hydrologic data, Montana, Nebraska, North Dakota, South Dakota, Wyoming, Data base, *Northern Great Plains, Madison Limestone.

Lists of machine-readable data files were developed for the Madison Limestone and Northern Great Plains Regional Aquifer System Analysis (RASA) projects. They are stored on magnetic tape and available from the U.S. Geological Survey. Record format, file content, and size are given for: (1) Drill-stem-test data for Paleozoic and Mesozoic formations, (2) geologic data from the Madison Limestone project, (3) data sets used in the regional simulation model, (4) head data for the Lower and Upper Cretaceous aquifers, and (5) geologic data for Mesozoic formations of the Northern Great Plains. (USGS)
W85-01790

HYDROLOGY OF LAKE PADGETT, SAXON LAKE, AND ADJACENT AREA, PASCO COUNTY, FLORIDA,
Geological Survey, Lakewood, CO. Water Resources Div.
S. E. Henderson.
USGS WRI/Open-File Report 82-759, 1983. 1 Map Sheet, 12 Fig, 3 Tab, 23 Ref.

Descriptors: *Lakes, *Surface-ground water relationships, Limnology, Dredging, Lake stages, Bathymetry, Aquatic plants, Hydrologic budget, Lake Padgett, Lake Saxon, Pasco County, Southwest Florida Water Management District, *Florida.

Development of lakeshore areas and nearby well fields could adversely affect Lake Padgett and Saxon Lake. The hydrology of the lake basins and the effects of present and future ground-water withdrawals were evaluated using available data and computer models developed for other investigations. Parts of both lake bottoms were dredged in 1967 and the lakes were connected by a canal. Dredging was more extensive in Saxon Lake than in Lake Padgett and the maximum depth of Saxon Lake was increased from an estimated 20 feet below mean stage to 30 feet below mean stage. Water-quality data indicate an increase in specific conductance, alkalinity, and organic nitrogen in Lake Padgett between 1964 and 1980, probably a result of residental development. Both lakes have extensive aquatic plant growth that may impede recreation in some areas. Fecal coliform counts infrequently exceed State criteria for waters used for recreation and for propagation and management of fish and wildlife. Well-field pumping at rates presently allowed will not affect the stage of the lakes. Increased pumping from South Pasco and Cypress Creek well fields would probably cause lake stages to decline by increasing leakage from the lakes to the underlying Floridan aquifer. (USGS)
W85-01826

RATIONALIZATION OF CENTRAL PLANNING IN WATER MANAGEMENT THROUGH THE INTRODUCTION OF EDP (RATIONALIZIERUNG DER ZENTRALEN PLANUNG IN DER WASSERWIRTSCHAFT DURCH EINSATZ DER EDV),
G. Stoye.
Wasserwirtschaft-Wassertchnik, Vol. 34, No. 2, p 34-35, February, 1984. 2 Fig.

Descriptors: *Planning, *Water management, *Data processing, *East Germany, Computers, Data acquisition, Data storage and retrieval.

The water-management industry in the German Democratic Republic has been using an electronic data processing (EDP) system capable of generating data to integrate annual plans for individual facilities into the general annual plan for the entire industry. The necessary short analysis time can only be achieved by distributing the load, i.e., by using computer facilities both at individual plants and centrally at the Ministry. A three-dimensional matrix was developed, consisting of data, column, and facility, in which the column entries included the base year, plan price basis 1, plan price basis 2, and government task/obligation (STAG/STAL). Because economic circumstances did not always allow each column corresponding to a data entry to be filled out, some columns (fields) had to be blocked by the computer. Generation of data corresponding to various demands of the plan was made possible by changing the matrix. The Unified Planning Project (UPP) used today is an expansion of the matrix designed to reduce the number of error corrections that must be made at the central computer facility by its two-stage nature: data collection, data check, and initial interpretation at the individual facility; integration and interpretation of individual plan data for the entire water industry by a central computer. A KRS 4200 computer is used in both stages with the ALGOL 4200 operating system. STAG/STAL data is collected on machine-readable data carriers and transmitted to the facilities for completion of the project. Integration of investment planning is facilitated by a rigidly programmed three-stage EDP project. (Gish-IVI)
W85-01879

THREE-DIMENSIONAL DIGITAL-COMPUTER MODEL OF THE PRINCIPAL GROUND-WATER RESERVOIR OF THE SEVIER DESERT, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
W. F. Holmes.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4179, 1983. 123 p, 8 Fig, 3 Tab, 15 Ref.

Descriptors: *Groundwater, *Model studies, Groundwater movement, *Groundwater recharge, *Potentiometric level, Great Basin, *Utah, *Groundwater budget, Sevier Desert.

The principal ground-water reservoir in part of the Sevier Desert, Utah was modeled using a three-dimensional finite-difference model. The model was calibrated by comparing computed and observed water-level measurements in 1952, simulating results of aquifer tests, and simulating ground-water withdrawals during 1952-81 and comparing computed water-level changes during 1952-82 to observed changes. The results indicate the model is capable of predicting future water-level changes. The report includes a complete listing of the model data for the 1952-82 simulation. (USGS)
W85-01925

WATER-LEVEL MAPS OF THE ALLUVIAL AQUIFER, NORTHWESTERN MISSISSIPPI, APRIL, 1982,
Geological Survey, Jackson, MS. Water Resources Div.
D. Darden.
Available from the OFSS, USGS, Lakewood, CO 80225, Price: $1.75 in paper copy, $1.00 in microfiche. USGS Water-Resources Investigations Report 82-4061, 1982. 1 Sheet Map, 1 Fig, 1 Tab, 7 Ref.

Descriptors: *Mississippi, Water resources, *Groundwater, *Maps, *Aquifer, *Water levels, Mississippi River valley, *Alluvial aquifer, Quarternary aquifers.

Water levels were measured in about 500 wells in the Mississippi River valley alluvial aquifer in northwestern Mississippi during the period April 12-23, 1982. The water-level change from April 1981 to April 1982, showed a general decline, but the water-level change from September 1981 to April 1982 showed some recovery. Water levels in the Delta were higher along the Mississippi River and Bluff Hills. Historically, water levels decline and rise as the amount of precipitation decreases or increases. Recently, continuous heavy pumping for irrigation has caused general water-level declines in the alluvial aquifer. (USGS)
W85-01926

DISTRIBUTION OF SELECTED CHEMICAL CONSTITUENTS IN WATER FROM THE FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. A. Corral, Jr.

Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4041, 1983. 1 Map, 4 Fig, 22 Ref.

Descriptors: *Water quality, *Aquifer characteristics, Southwest Florida Water Management District, *Florida, *Maps.

Generalized maps showing variations in concentration of chlorides, sulfates, hardness, and dissolved solids in the Floridan aquifer have been prepared as part of a cooperative program with the Southwest Florida Water Management District. This report covers 10 counties and parts of 6 others comprising the District. Data used to develop the report were retrieved from the water-quality files of the U.S. Geological Survey. Considerable vertical and areal variation of chemical constituents was found in ground water of the Floridan aquifer. In general, ground water becomes more mineralized with increasing depth and with increasing distance from recharge areas due to solution of minerals from the aquifer. Ground water was also more mineralized with proximity to the coast, due to saltwater intrusion. (USGS)
W85-01928

DATA FOR GROUND-WATER TEST HOLE NEAR NICOLAUS, CENTRAL VALLEY AQUIFER PROJECT, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. J. French, R. W. Page, and G. L. Bertoldi.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 83-273, September 1983. 60 p, 14 Fig, 10 Tab, 23 Ref.

Descriptors: *Test hole, *Electrical well logging, Radioactive well logging, Piezometers, *Water-level fluctuations, Water-quality data, Sacramento Valley, Central Valley, *California.

Preliminary data are provided for the third of seven test holes drilled as a part of the Central Valley Aquifer Project which is part of the National Regional Aquifer Systems Analysis Program. The test hole was drilled in the SW 1/4 NE 1/4 sec. 2, T.12N., R.3E., Sutter County, California, about 1 1/2 miles northwest of the town of Nicolaus. Drilled to a depth of 1,150 feet below land surface, the hole is cased to a depth of 100 feet and equipped with three piezometer tubes to depths of 311, 711, and 1,071 feet. A 5-foot well screen is set in sand at the bottom of each piezometer. Each screened interval has a cement plug above and below it to isolate it from other parts of the aquifer, and the well bore is filled between the plugs with sediment. Thirty-one cores and 34 sidewall cores were recovered. Laboratory tests were made for minerology, consolidation, grain-size distribution, Atterberg limits, X-ray diffraction, thermal conductivity, and chemical analysis of water. Geophysical and thermal gradient logs were made. The hole is sampled periodically for chemical analysis of the three tapped zones and measured for water level. This report presents methods used to obtain field samples, laboratory procedures, and the data obtained. (USGS)
W85-01929

HYDROLOGIC MAPS OF THE HIGH PLAINS AQUIFER, JANUARY 1981, SOUTHWESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
J. M. Spinazola.
Available from the OFSS, USGS, Lakewood, CO 80225. USGS Water-Resources Investigations Report 82-4079, 1982. 8 Sheet Maps, 2 Fig, 5 Ref.

Descriptors: *Approximation method, *Hydrologic data, Water distribution (applied), Water management (applied), *Maps, Kriging, Southwest Kansas Groundwater Management District No. 3, *Kansas, *High Plains aquifer.

A mathematical technique, called kriging, has been used in the form of a computer program to interpolate hydrologic data based on a network of 562 measured values. The computer program generated estimated values at the center of each 1-mile section in the Southwest Kansas Groundwater Management District No. 3 and facilitated contouring of selected hydrologic data that are needed in the effective management of ground water for irrigation. The kriging technique produced various maps that illustrate hydrologic conditions in the High Plains aquifer, the principal source of water in southwestern Kansas. Maps of the aquifer included the water-table altitudes, which ranged from about 2,040 feet to about 3,580 feet during January 1981, and saturated thickness, which ranged from 0 to over 600 feet during January 1981. (USGS)
W85-01930

TRENDS AND FLUCTUATIONS IN THE POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER, WEST-CENTRAL FLORIDA, 1961-80,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. K. Yobbi.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 82-4086, 1983. 1 p, 8 Fig, 1 Tab, 13 Ref.

Descriptors: Potentiometric surface, *Potentiometric flow, Hydrology, Hydrogeology, Floridan aquifer, *Florida.

Trends and fluctuations of water levels in wells tapping the Floridan aquifer in west-central Florida during 1961-80 are described in this report. Water levels in most of the study area have not changed appreciably, except in parts of Hardee, Hillsborough, Manatee, Polk, and Sarasota Counties. In these areas, ground-water pumpage by industry and agriculture caused long-term declines of water levels. The largest declines are centered in the agricultural area of southern Hillsborough and northern Manatee Counties where pumpage lowered water levels more than 30 feet since 1964. Hydrographs of 10 wells show that, during 1976-80, the downward water-level trend discontinued in areas of heavy pumpage and, in areas not affected by pumping, water levels remained fairly unchanged. Water levels rose more than 20 feet from May 1975 to May 1980 in southwest Polk, Hardee, northeast Sarasota, northeast Manatee, and southwest Hillsborough Counties. In the heavily pumped area of northern Hillsborough County, water levels rose 5 to 10 feet. From September 1975 to September 1980, water levels in southwest Polk County rose more than 10 feet. (USGS)
W85-01940

DATA FOR GROUND-WATER TEST HOLE NEAR BUTTE CITY, CENTRAL VALLEY AQUIFER PROJECT, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. J. French, R. W. Page, G. L. Bertoldi, and R. P. Fogelman.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 83-697, October, 1983. 54 p, 12 Fig, 10 Tab, 23 Ref.

Descriptors: *Test hole, *Electrical well logging, Radioactive well logging, Piezometers, *Water-level fluctuation, Water-quality data, Sacramento Valley, Central Valley, *California.

This report provides preliminary data for the third of seven test holes drilled as part of the Central Valley Aquifer Project which is part of the National Regional Aquifer Systems Analysis Program. The test hole was drilled in the SW 1/4 NE 1/4 sec. 32, T. 19 N., R. 1 W., Glenn County, California, about one-half mile south of the town of Butte City. Drilled to a depth of 1,432 feet below land surface, the hole is cased to a depth of 82 feet and equipped with three piezometer tubes to depths of 592 feet, 968 feet, and 1,330 feet. A 5-foot well screen is at the bottom of each piezometer. Each screened interval has a cement plug above and below it to isolate it from other parts of the aquifer, and the well bore is filled between the plugs with sediment. Nine cores and 49 sidewall cores were recovered. Laboratory tests were made for mineralogy, hydraulic conductivity, porosity, consolidation, grain-size distribution, Atterberg limits, X-ray diffraction, and chemical quality of water. Geophysical and thermal gradient logs were made. The hole is sampled periodically for chemical analysis and measured for water level in the three tapped zones. This report presents methods used to obtain field samples, laboratory procedures, and the data obtained. (USGS)
W85-01941

WATER-LEVEL MAPS OF THE ALLUVIAL AQUIFER IN NORTHWESTERN MISSISSIPPI, APRIL 1983,
Geological Survey, Jackson, MS. Water Resources Div.
D. M. Sumner.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4285, 1984. 1 Sheet, 4 Fig, 9 Ref.

Descriptors: *Potentiometric level, Aquifers, *Water level, *Alluvial aquifers, Mississippi River valley alluvial aquifer, Quaternary aquifers, *Mississippi.

Water levels were measured in about 500 wells in the Mississippi River valley alluvial aquifer in northwestern Mississippi during April 1983. Ground-water levels have declined in some areas in recent years as a result of heavy irrigation pumpage from this aquifer. Near the areas of principal recharge, along the major rivers, and near the Bluff Hills, ground-water levels appear to be relatively unaffected by the large aquifer drafts; whereas away from the areas of recharge, in the interior of the basin, ground-water levels have shown a long-term decline. (USGS)
W85-01944

MAJOR AQUIFERS IN MINER COUNTY, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 2F.
W85-01950

DEVELOPMENT AND FIELD TESTING OF A METHODOLOGY FOR ASSESSING COMMUNITY READINESS FOR SELF-HELP IN THE INSTALLATION, MAINTENANCE AND REPAIR OF WATER SUPPLY AND SANITATION FACILITIES,
Water and Sanitation for Health Project, Arlington, VA.
R. B. Isely.
Aqua, No. 1, p 3-10, 1983. 4 Fig, 2 Tab, 8 Ref.

Descriptors: *Community involvement, *Water distribution, *Water treatment, *Wastewater disposal, *Developing countries, *Social aspects, Algorithms, Maintenance, Costs, Public participation, Rural areas, Public health.

A particular gap in the planning capabilities of water and sanitation agencies of developing countries is the ability of field workers to systematically gather and use data on the capabilities of communities to organize efforts to install, maintain and repair water and sanitation facilities. In rural areas, determination of self-help capabilities of the community to formulate plans and take action often depends on the leadership of trained field workers (sanitarians, public health personnel, agricultural extension workers). A field data-collection instrument and a decision-making algorithm were developed to assist these field workers in selecting optimum modes of intervention in community actions. Development of adequate water supplies, maintenance of water delivery systems, and sewage treatment facilities are concerns detailed in plans for rural community involvement. (Wheatley-IVI)
W85-01980

GEOHYDROLOGIC DATA FOR TEST WELL USW G-4, YUCCA MOUNTAIN AREA, NYE COUNTY, NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
C. B. Bentley.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 84-063, 1984. 48 p, 21 Fig, 6 Tab, 6 Ref.

Descriptors: *Aquifer tests, *Hydraulic conductivity, *Water-level, *Geophysical logging, *Chemical analyses, *Nevada, Crater Flat Tuff, Yucca Mountain, Nevada Test Site, Nye County.

Data are presented on drilling operations, lithology, borehole geophysics, hydrologic monitoring, core analysis, water chemistry, pumping tests, and packer-injection tests for test well USW G-4. The well is one of a series of test wells drilled in and near the southwestern part of the Nevada Test Site, Nye County, Nevada, in cooperation with the U.S. Department of Energy. These test wells are part of the Nevada Nuclear Waste Storage Investigations to identify suitable sites for underground storage of high-level radioactive wastes. Test well USW G-4 was drilled to a total depth of 915 meters through volcanic rocks, consisting mostly of ash-flow tuff. Depth of water in the well during and after drilling and testing ranged from 538 to 544 meters below land surface, at approximate altitude of 728 meters above sea level. Drawdown in the well was about 3 meters after test pumping more than 5,000 minutes at a rate of 16 liters per second. A borehold-flow survey indicated that almost all water withdrawn from the well was contributed by the zone between a depth of about 865 and 915 meters below land surface. Analysis of a composite water sample collected after well completion showed the water to contain 216 milligrams per liter of dissolved solids, with relatively large concentrations of silica, sodium, and bicarbonate. (USGS)
W85-02031

DATA FOR GROUND-WATER STUDIES OF THE SAN JUAN BASIN, NEW MEXICO (1982-83),
Geological Survey, Albany, NY. Water Resources Div.
R. L. Klausing, and G. E. Welder.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 84-135, 1983. 46 p, 3 Fig, 2 Pl, 5 Tab, 2 Ref.

Descriptors: *Groundwater, Hydrographs, Observation wells, Water quality, *Data collections, *New Mexico, San Juan Basin, San Juan County, Four-corners area.

Ground-water data that can be used for futher hydrologic studies in the San Juan structural basin of New Mexico are reported. Descriptions and a location map of 64 observation wells, a list of water levels measured in the observation wells, water-level hydrographs of 32 wells, 15 partial chemical analyses of water samples from wells, and descriptions and a location map of 264 potential observations wells are included. The latter are wells for which good records exist. Their potential for use as observation wells needs to be verified in the field. (USGS)
W85-02034

PROJECTED PUBLIC SUPPLY AND RURAL (SELF-SUPPLIED) WATER USE IN FLORIDA THROUGH YEAR 2020,
Geological Survey, Tallahassee, FL. Water Resources Div.
S. D. Leach.
Florida Department of Natural Resources (Bureau of Geology) Map Series Number 108, 1984. 1 Map, 4 Fig, 2 Tab, 10 Ref.

Descriptors: *Florida, *Water use, *Public water supply, Rural (self-supplied), Hydrology, *Water supply, *Projection, Florida.

This report portrays Florida's past, present, and future freshwater requirements for public supplies and for rural domestic and livestock self-supplied use. The combined freshwater use by public supplies and rural domestic and livestock use increased from 225 million gallons per day (Mgal/d) to 1,672 Mgal/d in 1980, and is projected to reach 3,235 Mgal/d by the year 2020. In addition to the stress on the overall freshwater supply resulting from population growth, average per capita use for public supplies and rural use increased from 81 gallons per day (gal/d) in 1950 to 172 gal/d by 1980. This increase in per capita use has been leveling off for the past several years prior to 1980 and is expected to show only a small increase in future years. (USGS)
W85-02036

OCCURRENCE, QUALITY, AND USE OF GROUND WATER IN ORCAS, SAN JUAN, LOPEZ, AND SHAW ISLANDS, SAN JUAN COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
K. L. Whiteman, D. Molenaar, G. C. Bortleson, and J. M. Jacoby.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4019, 1983. 12 Maps, 19 Fig, 15 Tab, 30 Ref.

Descriptors: *Groundwater, Hydrogeology, *Water quality, *Saline water intrusion, Bacteria, Water use, San Juan County, *Washington, Lopez Island, Orcas Island, San Juan Island, Shaw Island.

Ground water, which supplies most of San Juan County's water needs, occurs in both bedrock and glacial drift. Water in the bedrock occurs in fractures in the otherwise dense, poorly permeable rock. Deposits of sand and gravel in the glacial drift provide the best yields to wells drilled into unconsolidated materials. Specific capacities of bedrock wells are typically low, and those of glacial-drift wells considerably higher. Ground water is high in dissolved solids and hardness; 29 of 56 wells sampled had water classified as very hard. Sixteen percent of the 171 ground-water sites tested for indicator bacteria had positive counts of one or more of these bacteria: total coliform, fecal coliform, fecal streptococcus. Nine percent of the 279 wells sampled for chloride in September 1981, appear to be affected by seawater intrusion. All of these wells are located within a mile of the coast; 60 percent of these wells are on Lopez Island. In 1980 an estimated total of 220 million gallons of ground water was withdrawn for all uses. Ninety percent of all ground-water use is for domestic and public supply purposes. Heavy pumpage on northern and southern Lopez Island correlates with areas having high chloride concentrations. (USGS)
W85-02043

DRAINAGE BASINS IN DUVAL COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. B. Stone, and J. B. Largen.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations 82-4069, 1983. 1 Map, 1 Fig, 1 Tab.

Descriptors: *Surface drainage, Drainage, *Florida, River systems, *Watersheds (basins), *Drainage systems, Drains, Atlantic coastal plain, Coastal plains, Drainage water, Flood plains, Small watersheds, Tributaries, Lake basins, St. Johns River basin, Nassau River basin, St. Marys River basin, Coastal area, Duval County, Drainage divide, Subbasin, Intracoastal Waterway, Southeast United States, Jacksonville.

The drainage basins and subbasins in Duval County, Florida, are delineated on this atlas map. The county's 840 square-mile area is drained by three major river systems; the St. Johns, 668 square miles; Nassau, 113 square miles; and St. Marys, 59 square miles. The remainder of the county is drained by a network of small streams that flow into either the Intracoastal Waterway or directly into the Atlantic Ocean. The sub-basins range in size from less than one square mile to more than 50 square miles. (USGS)
W85-02046

RECHARGE AND DISCHARGE AREAS OF THE FLORIDAN AQUIFER IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT AND VICINITY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. G. Phelps.
USGS Water-Resources Investigations Report 82-4058, 1984. 1 Map, 4 Fig, 2 Tab, 37 Ref.

Descriptors: *Groundwater recharge, *Groundwater discharge, Water balance, *Florida, Floridan aquifer, St. Johns River Water Management District.

The Floridan aquifer is the principal source of most of the freshwater used in the St. Johns River Water Management District. An important step in managing water resources is the delineation of recharge and discharge areas. Geohydrologic factors to be considered when delineating recharge and discharge areas include: altitude and configuration of the potentiometric surface; direction and magnitude of the gradient between the water table and the potentiometric surface; and thickness and permeability of the overlying sediments. Recharge to the aquifer comes almost entirely from rainfall within the Water Management District. Significant recharge occurs where the aquifer is at or very near land surface, and where the overlying sediments are very permeable sand so that recharge takes place downward leakage. Recharge also occurs through sinkholes, sinkhole lakes, and other lakes that have a good connection to the aquifer. Major recharge areas are delineated on the map. Discharge occurs in areas of artesian flow (where the potentiometric surface is above land surface), primarily by diffuse upward leakage and by discharge from springs. Fifty-five springs, with total discharge of about 1,600 million gallons per day, are in the Water Management District. Areas of discharge and the location of springs are shown on the map. In 1980, total pumpage in the Water Management District was about 1,000 million gallons per day. Under predevelopment conditions, discharge by springs and upward leakage approximately balanced recharged. Additional discharge by pumpage may or may not be balanced by decreased spring discharge of increased downward leakage. Examination of long-term water level trends can indicate if recharge and discharge balance. Graphs of rainfall, water levels, and municipal pumpage for Jacksonville, Orlando, and Daytona Beach are shown on the map. (USGS)
W85-02049

ALTITUDE AND GENERALIZED CONFIGURATION OF THE TOP OF THE FLORIDAN AQUIFER, ST. JOHNS COUNTY, FLORIDA,
Geological Survey, Jackson, MS. Water Resources Div.
R. M. Spechler.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4101, 1983. 1 Map, 3 Fig, 1 Tab, 9 Ref.

Descriptors: Geology, Stratigraphy, *Aquifers, *Maps, Groundwater, *Floridan aquifer, St. Johns County, *Florida.

The Floridan aquifer is the principal source of freshwater to wells in most of St. Johns County. The aquifer consists of a thick sequence of interbedded limestone and dolomite of Eocene age. The top of the Floridan aquifer, which is irregular throughout St. Johns County, ranges from less than 90 feet below sea level in the extreme southestern part to more than 360 feet below sea level in the northern part. (USGS)
W85-02050

COMPUTATION OF CONTINUOUS STREAMFLOW RECORDS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W85-02053

8. ENGINEERING WORKS

8A. Structures

SEISMIC DESIGN CRITERIA FOR BURIED WATER PIPELINE IN PUERTO RICO,
Puerto Rico Univ., Mayaguez. Dept. of Civil Engineering.
R. Jimenez-Perez.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-212380, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, August 1983. 21 p, 9 Fig, 2 Tab, 15 Ref. Project No. OWRT A-076-PR(1), Contract/Grant No. 14-34-0001-2141.

Descriptors: *Pipelines, *Seismic properties, Design criteria, Puerto Rico, Water supply.

The primary objective of this report was to determine the effect of earthquakes on buried pipelines constructed in Puerto Rico. The work established the design earthquake parameters required together with a simplified dynamic analysis technique that considers the effect of the time history variation of the earthquake and of different soil layers along the conduit alignment. The simplified method assumes that the soil mass and the pipeline react to the earthquake ground excitation as a unit and that there are no relative displacements between the soil and the pipeline. The simplified model was used to determine the maximum axial strains for pipelines placed in homogeneous or in different soil masses. The study concluded that the axial strain is smaller for stiffer soils regardless of the pipe length embedded in the soil mass. The axial strains determined from this analysis can be combined with the additional stresses to determine the failure criteria for the pipeline.
W85-01821

REBUILDING OF THE HYDRO-ELECTRIC POWER STATION OF SPIEZ (KRAFTWERK SPIEZ ERNEUERUNG 1982-1985),
Bernische Kraftwerke A.G. (Switzerland).
P. Hartmann.
Wasser, Energie, Luft, Vol. 76, No. 3/4, p 29-30, 1984. 2 Fig.

Descriptors: *Hydroelectric plants, *Water resources development, *Spiez, *Switzerland, Hydroelectric Plant, Simme River, Kander River, Construction, Turbines, Pipes, Dam construction.

The hydroelectric power station of Spiez was built originally in 1899 on the River Kander. In 1908 the station was expanded by adding runoff from the watershed of the River Simme. Currently, rebuilding is again underway, having begun in 1982 and expected to be completed by 1985. Rebuilding will include both the control dams of the Kander and the Simme. The previous four feeding water pipes will be replaced by a single pressure pipe. The former power house is to be replaced with a new power station holding two Francis turbine groups for a power level of 18.2 MW. This will replace the former six rotary current groups and the former three monophase current groups for railway supplies. The rest water left in the River Simme will power a small power station using a head of 15 m. Annual energy production, which had been 74 GWh, will be increased to 93 GWh. (Baker-IVI)
W85-01857

WEINZODL POWER STATION ON THE MUR (DAS KRAFTWERK WEIZODL AN DER MUR),
Suiselectra Ingenieurunternehmung A.G., Basel.
K. Kaufmann.
Wasser, Energie, Luft, Vol. 76, No. 3/4, p 49-51, 1984.

Descriptors: *Weinzodl, *Mur river, *Austria, *Hydroelectric plants, Turbines, Coatings, Turbine buckets, Catchment area, Small head hydropower, Design flow.

The Weinzodl power station is situated on the Mur river in the Steiermark region of Austria. It consists of a machine house with two Straflo turbines (horizontal axle, double regulation, outer-rim generator) on the left bank with an adjoining three-sectional weir having a 7.5-m-high baffle plate. A mill canal branches off from the right weir pier; the 2.3-m head thereby created is utilized by a small power station (0.2 MW output, 11 cu m/sec usable water volume, 1 Straflo turbine). The main power station is designed for a maximum reservoir level of 364 m, a head of 10 m, and a design flow of 180 cu m/sec. Design flow is reached or exceeded on 42 days in an average year; mean annual flow is 115 cu m/sec, and flood flow can reach 1,800 cu m/sec. Output of the main power station is 25.0 GWh in the 6-mo winter season and 50.0 GWh in summer at the small power station, it is 1.5 GWh annually. The catchment area comprises 7,000 sq km. The facility is situated in a groundwater-conservation area, which necessitated special studies and procedures. Swiss companies played a significant role in design and construction and supplied the turbines. Of particular interest are the measures for inner conservation of the turbines and the coating of the rust-free stainless-steel turbine buckets at this and other power stations on the Mur. (Gish-IVI)
W85-01860

CONSTRUCTION OF THE ALICURA HYDROELECTRIC FACILITY IN ARGENTINA (DER BAU DER WASSERKRAFTANLAGE ALICURA IN ARGENTINIEN),
Electrowatt Engineering Services Ltd., Zurich (Switzerland).
H. Busenhart.
Wasser, Energie, Luft, Vol. 76, No. 3/4, p 57-60, 1984. 4 Fig.

Descriptors: *Hydroelectric plants, *Alicura, *Argentina, *Dam construction, Transmission lines, Earth dams, Outlets, Gates, Intakes, Cofferdams.

The Alicura hydroelectric facility, which is soon to begin operating, is situated on the Limay river in southern Argentina and is the uppermost of a chain of four such facilities. It is designed for an output of 1,000 MW and will produce 2,500 GWh per year. A 500-kV transmitter is under construction that will by 1985 cover the 1,700 km to Buenos Aires. The earth dam is 120 m high with a volume of 13 million cu m; its reservoir capacity is 2.4 billion cu m. At the dam site, the river curves sharply; the bank on the inner side is steep (50% gradient) with a plateau at the top, on which the intake and flood-control facilities are built. One of the two diversion pipes used during construction is now the bottom outlet. The coffer dams were integrated into the body of the main dam. At the intersection of the bottom outlet and grout curtain, two synchronously controlled operating gates and two gates for repair purposes were installed, each 2.4 m wide and 3.0 m high. The power house with its 116-m head and 4 250-MW Francis turbines lies on the left bank. Its water is channeled from reservoir to intake facility and via four pressure pipes to the power house. Both intakes are below the grout curtain. The distance between intake and power house is thus so short that no water tower is needed; however the disadvantage is that the channel in this area must be carefully sealed and drained. The entire project lies in an area of sandstone with layers of clay. Companies from Europe, the USA, and Japan, as well as Argentina (which contributed most of the personnel) participated in the project. Switzerland contributed 6% of the effort but retained 100% of the responsibility. (Gish-IVI)
W85-01862

HYDROELECTRIC POWER STATION AT THE NETSTAL LIME FACTORY (DAS WASSERKRAFTWERK DER KALKFABRIK NETSTAL AG),
Electroplan, Basel (Switzerland).
E. Pucher.
Wasser, Energie, Luft, Vol. 76, No. 5/6, p 99-102, 1984. 6 Fig, 1 Tab, 3 Ref.

Descriptors: *Hydroelectric plants, *Netstal, *Switzerland, Turbines, Trash rakes, Automation, Intakes, Gates, Overflow valves, Hydroelectric power, Generators.

A new hydroelectric power station was designed at the site of an old one at the Nestal lime factory on the Linth river, Switzerland. The object was to expand water-flow utilization while retaining the old weir, intake site, and reservoir capacity. The application of innovative devices (floating beam, steel cantilever still, new type of overflow valve floating-matter transporter, automated control room) can result in an economically viable facility even in unfavorable circumstances. Reservoir capacity remained at 457.35 m, usable water volume was increased from 4.0 to 4.0-20.0 cu m/sec, a horizontal Kaplan-S pipe turbine replaced the old Francis shaft turbine, turbine output rose from 132 to 802 kW, generator output increased from 85-110 kW to 148-660 kW, average output was 530 kW (90 kW at the old facility), and annual energy production was 4.2-4.5 GWh as compared to 0.9-1.05 GWh previously. The inlet facility consists of a rake, its cleaning machine, overflow valve, and scour gate. Floating matter caught in the rake is thrown into a 1-m-wide channel, which can be heated. From here it is driven by a motorized transporter into a trench. This device obviates the necessity for an inclined channel and conserves rinse water; in winter, ice problems are avoided. The automated control room allows the facility to be operated by one man. Power-house construction cost was 5 million Swiss Francs; investment cost excluding headwater channel was 5,350 Francs/kW. (Gish-IVI)
W85-01866

PROGRESS IN ROCKFILL DAMS,
Cooke (J. Barry), Inc., San Rafael, CA.
J. B. Cooke.
Journal of Geotechnical Engineering, Vol. 110, No. 10, p 1383-1414, October, 1984. 10 Fig, 2 Tab, 28 Ref.

Descriptors: *Dam construction, *Rockfill dams, *Reviews, Embankments, Design criteria, Construction, Performance evaluation.

The contributions of Karl Terzaghi, a major contributor to progress in embankment dams, are noted and a history of parallel development of earth core and concrete-face rockfill dams is presented along with an analysis of the impact of compacted rockfill on the concrete face rockfill dams. Emphasis is directed towards the concrete face type of rockfill dam. The early period from 1850 to 1940 stressed mainly the construction of dumped rockfill dams. The transition period from 1940-1965 saw developments in the area of engineered rockfill dams. The modern period from 1965 to 1982 has enjoyed widespread use of compacted rockfill dams of earth core and concrete face type. Recent progress in the design and construction of this type of dam is outlined. Design trends and performance data are reviewed. Specific areas of concern include the use of water in compacted rockfill, rock quality, use of gravel, modern earth core compacting techniques, modern concrete face rockfill dam construction, cold weather sites, seismic resistance of compacted rockfill, pumped storage cyclic operation, toe slab foundations, stability, upstream face rockfill, face slab placement, construction scheduling, river handling, and rockfill placement. (Baker-IVI)
W85-01870

SHEETPILE INTERLOCK TENSION IN CELLULAR COFFERDAMS,
Southern Illinois Univ. at Edwardsville. Dept. of Civil Engineering
M. P. Rossow.
Journal of Geotechnical Engineering, Vol. 110, No. 10, p 1446-1458, October, 1984. 13 Fig, 10 Ref.

Descriptors: *Cofferdams, *Construction, *Tension, *Sheetpile interlock tension, Design criteria, Dams, Analytical methods, Mathematical equations.

An analytical method is presented for the calculation of the interlock tension in the sheetpile walls of a cellular cofferdam. The method is based on the assumption that the walls act as inextensible membranes offering no resistance to bending about

a vertical axis. A set of governing equations has been derived by stating the condition of equilibrium and compatibility. Examination of the calculations for an example problem reveals that the method provides theoretical backing for Swaket's equation for the force in the common wall (Swatek, E.P., Cellular Structure Design and Installation, Proceedings of the Conference on Design and Installation of Pile Foundations and Cellular Structures, Envo Publishing Co., Inc. Pennsylvania, 1970, pp. 413-423.). The calculations also suggest how Swatek's equation may be generalized to allow the value of the fill pressure in the arc-cell to differ from that in the main-cell. The calculations in the example also confirm the previously observed importance of the rotation of the Y connection in carrying the loads. Although the method has been presented here for the particular sheetpile wall configuration corresponding to a circular cofferdam, the basin approach also applies to other sheetpile structures. Since the method's predictions of interlock forces depend crucially on the specification of the fill pressure acting on a wall, the confidence to be placed in the predictions is directly related to the confidence with which a single number can be used to represent the complex soil-structure interaction which occurs in a flexible earth-retaining structure. (Baker-IVI)
W85-01872

MICROCOMPUTER PROGRAMS FOR DESIGNING WATER SYSTEMS,
Public Works Dept. of Malaysia, Kuantan.
E. S. Koh, and D. R. Maidment.
Journal of the American Water Works Association, Vol. 76, No. 7, p 62-65, July, 1984. 1 Fig, 2 Tab, 13 Ref.

Descriptors: *Computers, *Design, *Water distribution, Developing countries, Water demand, Water supply, Pumps, Pipelines, Storage reservoirs, Cost analysis.

The use of microcomputers can help engineers and planners in designing water supply systems, especially for developing countries. Five programs written for microcomputers (DEMAND, YIELD, MAINS, RESERV, AND COSTS) deal with a sequence of problems in the design of a water supply system: projecting demand, determining the yield of a water source, calculating pump and pipeline capacities, sizing a storage reservoir at the location of demand, and performing an economic analysis of alternative designs. (Moore-IVI)
W85-01903

CORROSION AND PROTECTION OF PIPES IN DEVELOPING COUNTRIES,
A. Baltes.
Aqua, No. 4, p 161-167, 1983. 12 Fig, 17 Ref.

Descriptors: *Pipelines, *Pipes, *Corrosion control, *Protection, Cathodes, Coatings, Conveyance structures, Water transport, Water mains, Developing countries, Soil resistivity, Cathodic protection.

For effective protection against corrosion of cast iron and steel water pipelines in developing countries - where soils are often highly corrosive - the use of high-grade coating materials and cathodic protection, as well as regular maintenance, is vital. In soils of low resistivity the annual rate of corrosion may be as high as 1 mm. Pipes are coated by bituminous or plastic material to isolate the metal from the soil. The impact strength and the compressive strength of the coating material and coating application in accordance with standards and specifications are vital for effective protection. Measures taken to protect the inner surface of water pipelines from corrosion and encrustation include grout lining. For effective cathodic protection at acceptable cost, pipelines must be conductive, they must be isolated from grounded pipeline components, and the resistivity of the coating material used must be sufficiently high. Pipelines may be protected cathodically by impressed current systems or by sacrificial anode systems. If power supply or spares pose a problem, the use of galvanic anodes in low-resistivity soils may be a reasonable option. Like other plants and installations, cathodic protection systems must be monitored and maintained. Cathodic protection engineers, who may be company trained or trained at specialized institutions are needed for the operation of cathodic protection systems. In many applications, effective and economic protection is achieved by combining pipeline coating and cathodic protection. (Collier-IVI)
W85-01991

COMPARISON OF WATER MAINS CLEANING TECHNIQUES - THE EXPERIMENT OF BEGLES (COMPARAISON DES TECHNIQUES DE CURAGE DES CONDUITES D'EAU POTABLE - L'EXPERIENCE DE BEGLES),
Lyonnaise des Eaux, Bordeaux (France).
J. Petry, and Ph. de La Clergerie.
Aqua, No. 5, p 231-233, 1983. 6 Fig.

Descriptors: *Pipelines, *Cleaning, *Water mains, Water conveyance, Water distribution.

The practice of replacing water pipes is not only expensive, but it also causes great inconvenience for those relying on the use of those pipes. Costs of iron, excavating, road repairing and manpower have all increased over the past few years. Managers of water supply systems are compelled to clean pipes, if possible, rather than to replace them. The three methods of soft scrapers, rods, and metal scrapers were used to clean various heavily encrusted pipes in the district of Begles, part of the Urban Community of Bordeaux. A comparison of the effectiveness of these three methods is offered. (Baker-IVI)
W85-01999

WORLD'S LONGEST TUNNEL,
Helsinki Metropolitan Area Water Co. (Finland).
P. Erkola.
Aqua, No. 6, p 272-274, 1983. 2 Fig.

Descriptors: *Tunneling, *Helsinki, *Finland, Lake Paijanne, Construction, Water distribution, Water supply, Water conveyance.

The Paijanne Tunnel was constructed in Finland to transport water and to ensure the supply to Helsinki for many years in the future. The tunnel is 120 km long through solid rock from Lake Paijanne to the outskirts of the city. Removal of half a million lorry loads (10 cu m) of rubble was necessary for the tunnel to be built. Quarrying activities alone occupied one and a half million manhours and 40,000 blasting operations. The cost was in US dollars, 113 million. Work was begun in 1973 and completed in 1982. The work, when completed, produced the world's longest continuous rock tunnel. (Baker-IVI)
W85-02003

8B. Hydraulics

MODELLING CRITERIA FOR BUBBLE PLUMES - A THEORETICAL APPROACH,
National Water Research Inst., Burlington (Ontario).
G. Tsang.
Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 293-298, June, 1984. 1 Fig, 9 Ref.

Descriptors: *Bubble plumes, *Model studies, Bubbles, Plumes, Buoyancy, Gases, Expansion, Theoretical analysis.

A theoretical investigation is made to derive the parameters that govern the dynamic similarity between prototype and model bubble plumes. It is shown in the study that, for a complete similarity between the prototype and the model, the buoyancy flux from the source, the size of the bubbles, and the expansion of gas bubbles all have to be simulated. This is translated into the observation of the Froude law, the Weber law, and the expansion law in the model study. The expansion law requires that, for a reduced model, the study be conducted under partial vacuum and, for an enlarged model, the study be conducted under pressure. The physical properties of common fluids impose severe constraints in the model study. If the Weber law is to be satisfied, the smallest model permissible will only be half the prototype size. To conduct experiments under partial vacuum, the boiling of the model liquid has to be contended with. For practical reasons, a certain degree of violation of the similarity laws seems to be unavoidable. The theoretical investigation calls for systematic experiments to examine the quantitative effect of the different similarity parameters and the degree of violation of the similarity laws permissible in solving practical problems. (Author's abstract)
W85-01715

HYDRODYNAMIC OF CIRCULAR PRIMARY CLARIFIERS,
Windsor Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W85-01716

MECHANICS OF MUDFLOWS,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
J. D. Higgins, B. Naik, S. V. Mills, H. Copp, and J. A. Roberson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-195858, Price codes: A07 in paper copy, A01 in microfiche. Washington Water Research Center Report 51, October 1983. 116 p, 29 Fig, 3 Tab, 49 Ref, 1 Append. Project No. OWRT C-10110-V(1463)(1), Contract/Grant No. 14-34-0001-1463.

Descriptors: *Mudflows, Hydrodynamics, Flow characteristics, *Hazard assessment, Steady-state motion, *Fluid mechanics, Hydromechanics, Model studies, Bingham model, Rheology, *Turbulent flow, Velocity profiles, Friction.

The mudflow hazard associated with volcanoes or otherwise is real, yet little is understood of the fluid mechanics governing the flow. Two tasks were investigated in this research. First, common characteristics of sites where mudflows have occurred and mud material properties were examined. Second, the equations for the fundamental hydromechanics phenomena of mudflows under steady-state motion were developed. A Bingham model was adopted for the study of rheology and fluid mechanics of mudflows. A method was developed to estimate Bingham constants given water content and the grain-size distribution of solids. A fluid mechanics theory of Bingham fluid flow in a wide open channel was developed, as well as equations for predicting the transition from laminar to turbulent flow. These were verified through experiments in a flume using a mud slurry. Theories of transitional and turbulent uniform flow in smooth and rough open channels were developed. Velocity profiles and friction factors predicted by the theories were verified with experimental data. The methodologies developed to compute the flow rates for a given depth, channel characteristics, and fluid characteristics are presented as a computer program.
W85-01816

BASIC CONCEPTS OF KINEMATIC-WAVE MODELS,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2A.
W85-02035

8C. Hydraulic Machinery

ASYNCHRONOUS GENERATOR; AN ALTERNATIVE TO THE SYNCHRONOUS GENERATOR FOR SMALL HYDROELECTRIC POWER STATIONS WITH OUTPUT UP TO 20,000 KW (DER ASYNCHRONGENERATOR; EINE ALTERNATIVE ZUM SYNCHRONGENERATOR FUR KLEINE WASSERKRAFTANLAGEN MIT EINER LEISTUNG BIS 20000 KW),

Brown, Boveri und Cie A.G., Baden (Switzerland).
R. Kallmann.
Wasser, Energie, Luft, Vol. 76, No. 3/4, p 33-43, 1984. 21 Fig, 9 Ref.

Descriptors: *Hydroelectric powerplants, *Asynchronous generators, *Switzerland, Small hydroelectric plants, Costs, Overspeed stress.

Decreases in the energy supply and increases in its cost have combined to make small hydroelectric power stations (HEP; output 10,000-20,000 kW) more viable. Such a facility with an asynchronous generator (AG) is competitive with one having a synchronous generator (SG) due to favorable installation costs, despite the necessary compensating condensors. AGs are mechanically robust and practically maintenance-free (as are SGs); have no special requirements regarding moment of inertia (SGs require a minimum flywheel mass); have a small air gap that must sometimes be enlarged due to overspeed, which influences performance; are superior to SGs at the same output in terms of mass, space requirements, and economy; require reactive power via condensors or the network (SGs can put out or take in reactive power); need adjustable condensors or saturation throttles to maintain tension when operating alone with variable loads; have condensors requiring power-surge protection; need no synchronizing device (SGs require one for parallel operation); and, unlike SGs, do not require frequency regulation during standalone operation. The best conditions for installation of an AG are parallel operation with a short feed line or an SG nearby to provide reactive power. The AG can then be operated with constant or variable load. At the end of 1980, there were 78 AGs operating in small HEPs in Switzerland, of which 24 were installed after 1971. Technical and economic power-output limitations, which are determined mechanically by overspeed stress rather than electrically, are about 24, 30, and 45 MW for AGs with 4, 6, and 8 poles, respectively. (Gish-IVI)
W85-01858

PUMPS FOR LIQUIDS, ESPECIALLY FOR WASTEWATER (PUMPEN FUR FLUSSIGKEITEN, INSBESONDERE FUR ABWASSER),
Kantonales Amt fuer Gewasserschutz, Sankt Gallen (Switzerland).
R. Weber.
Wasser, Energie, Luft, Vol. 76, No. 5/6, p 77-80, 1984. 10 Fig.

Descriptors: *Pumps, *Wastewater facilities, Water conveyance, Piston pumps, Centrifugal pumps, Particulates, Hydraulic machinery.

Pumps designed for various branches of the water and wastewater industries are described and illustrated. Next to the electric motor, the pump is considered the most versatile machine. Of the many types of pump, the piston and centrifugal pumps are the most important. In the water supply industry, automatic hydraulic controllers are offered as a unit and are used mainly when the water supply is reliable but water pressure is not; the unit comprises a pump and pressure tank with air cushion and controller mounted on a shock-absorbent base. The Hany standard pump is used in clean or lightly polluted liquids without coarse particles, as circulation and pressure-raising pumps in water supply, heating installations, and industry; depending on engine revolution and power, pumping capacity is 3-380 cu m/hr (0.8-100 l/sec). In the wastewater industry, specialized pumps are needed. For polluted, untreated media containing foreign bodies as big as the pressure-connection diameter, a clog-free passage is of primary importance. The 'Turo' free flow pump fulfills this criterion, is also economical, and runs quietly; power transfer to the pumped medium occurs according to the hydraulic coupling principle; and performance is 1-150 l/sec. The 'Ama-Drainer' is an underwater pump suited to empty and automatically keep dry excavations, shafts, and subterranean passages. It can be used in the industrial and municipal fields for lightly polluted water with solid particles up to 10 mm in diameter. The 'Biral' wastewater and feces pump has a two-polar motor and a choice of four wheels (swivel, single-,double-, or multichannel) as well as free passage corresponding to the pressure-connection diameter guaranteed for the first three wheel types. Wastewater with solids can be pumped without clogging with the single channel or swivel wheel with a four-pole motor. (Gish-IVI)
W85-01864

PUMP STATION DESIGN: THE BENEFITS OF COMPUTER MODELING,
Pirnie (Malcolm), Inc., Newport News, VA.
M. P. Robinson, Jr., and R. E. Blair, Jr.
Journal of the American Water Works Association, Vol. 76, No. 7, p 70-77, July, 1984. 7 Fig, 5 Tab.

Descriptors: *Computer models, *Pumping plants, *Design, *Norfolk, *Virginia, Hydraulic machinery, Mathematical models, Pumps, Valves, Water distribution.

The Norfolk, Virginia water system serves the city's residential, commercial, and industrial demands, and in addition, serves the south Hampton Roads naval facilities and provides wholesale supply to the city of Virginia Beach. Concern about the city's ability to meet the increasing demand from Virginia Beach while maintaining reliable service to retail customers led to the use of a distribution system mathematical model for a refined analysis of explicit pump station design criteria. Specific emphasis is given to: selection of optimum efficiency design points and pump characteristics curves; selection of the most efective combination of pumps; and determination of backpressure valve control settings for the ground-level tank replenishment process. The effort expended in developing and applying mathematical models to distribution system and pump station design analyses is well repaid in the savings that result from improved design and operation. (Moore-IVI)
W85-01905

8D. Soil Mechanics

SEISMIC DESIGN CRITERIA FOR BURIED WATER PIPELINE IN PUERTO RICO,
Puerto Rico Univ., Mayaguez. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8A.
W85-01821

EARTH FOUNDATION TREATMENT AT JEBBA DAM SITE,
Montreal Engineering Co. Ltd., St. Catharines (Ontario).
Z. V. Solymar, B. C. Iloabachie, R. C. Gupta, and L. R. Williams.
Journal of Geotechnical Engineering, Vol. 110, No. 10, p 1415-1430, October, 1984. 16 Fig, 1 Tab, 4 Ref.

Descriptors: *Dam construction, *Jebba Dam, *Niger River, *Nigeria, *Foundation rocks, *Sand, Alluvial soils, Blasting, Vibrocompaction.

The Jebba Main Dam is founded on alluvial sands up to 230 feet in depth. In situ deep densification of loose, clean sands was required to depths as great as 131 ft below the original river bottom to provide safe foundation support for this dam on the Niger River. The required depth of treatment was unprecedented, and the volume of sand to be densified made this one of the largest in place densification projects ever undertaken. Deep blasting was used to densify the sand in the depth range of 82 ft to 131 ft below original bottom. Calculations based on measured settlements show that average improvement, in terms of relative density due to blasting over the full depth of the affected material, varies between 5 and 16 for an average of 10 percentage points. Both the treatment depth and the magnitude of explosive charges exceeded the corresponding values on previous projects by a factor of about two. Vibrocompaction was used to achieve the required densification to depths of 98 ft beneath the ground surface. The sand at this site was well suited for densification by this means, with some problems arising at the beginning when procedures had to be developed to facilitate probe penetration to the required depth. Site mapping of the initial sand density from definition of zones to be densified was done using the Static Cone Penetration Test. While densification occurred immediately after blasting and during vibrocompaction, increases in penetration resistance continued over substantial time periods of weeks to months in duration. Account of this time effect should be taken in the specification and evaluation of sand densification. (Baker-IVI)
W85-01871

8F. Concrete

MEASUREMENT OF CONCRETE PERMEABILITY,
Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.
B. B. Hope, and V. M. Malhotra.
Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 287-292, June, 1984. 5 Fig, 1 Tab, 3 Ref. D.S.S. contract OSU80-00104.

Descriptors: *Concrete testing, *Permeability, Concrete technology, Permeability coefficient, Water/cement ratio.

Because of the generally low permeability of concrete, either the length of path along which permeability is to be measured must be relatively small or the driving force must be relatively large to avoid an undue length of time for the test. In the proposed method, the concrete samples are cast in epoxy resin before insertion in a pressure cell. Uniaxial water flow, under pressures up to 3.5 MPa, is ensured by O-ring seals. The higher pressures which can be used with this method mean that larger, more representative speciments can be used and test results obtained in a reasonable length of time. The test method and apparatus appears to present a valid means of determining coefficient of permeability for concrete mixes with a wide range of water/cement ratios and air contents. The test is adaptable in that the hydraulic gradient applied to the sample can be varied as well as the fluid used for testing. The effect of a fluid other than water, or the addition of chemicals to the water used, can be examined. (Moore-IVI)
W85-01714

CONCRETE IN HYDRAULIC ENGINEERING FOR A BETTER ENVIRONMENT (BETON IM WASSERBAU FUR BESSERE UMWELT),
G. Brux.
Wasser, Energie, Luft, Vol. 76, No. 3/4, p 53-56, 1984. 5 Fig, 1 Tab.

Descriptors: *Concrete construction, *Hydraulic engineering, *Germany (Federal Republic), Wastewater treatment facilities, Water treatment facilities, Dam construction, Arch dams.

The Kohlbrandhoft (K) wastewater treatment facility handles 88% of Hamburg's (Federal Republic of Germany) municipal wastewater (0.5 million cu m/day) and is situated on an artificial peninsula at the confluence of the Norderelbe and Kohlbrand (Suderelbe) rivers. With the 1973 expansion of the Nord plant, lack of space meant the abandonment of conventional construction techniques: very deep preliminary-treatment basins with funnels in the center, block construction of the activation facility, and tertiary-treatment tanks built on top of one another. Similar conditions existed during construction of the activation facility, and tertiary-treatment tanks built on top of one another. Similar conditions existed during construction of the biological stage at K Sud (start-up in 1983), which has double-decker tertiary treatment, small settling tanks with horizontal flow built in block fashion behind larger, vertical-flow tanks, and six activation tanks with five aeration cycles operated in cascade form. The phosphate-removal facility at the 4-sq-m Tegelersee in West Berlin comprises an intake complex and a filtration/flocculation facility. The North Trench complex (intake facility, macrorake, intake basin, sludge bins, weir, outlet facility, and cascades) is situated

in the lake inflow and is constructed of water-repellent concrete parts with anchored sheet pilings. The rake has a 12-m-high aluminum-coated steel construction to prevent weather-related damage. The concrete filtration/flocculation plant consists of three 43 x 47 x 8 m underground boxes, each containing 6 filter chambers and a sludge and pure-water tank, with flocculation basins above them, forming a triangular hall containing a distribution tower. The high steel content in the filter foundations (380 kg/cu m concrete) made construction difficult. The 185-m high Oymapinar arch dam in a gorge of the Manavgat river in southern Turkey is 25 m thick at the foot and 5 m thick at the crown, requiring 0.65 million cu m concrete. Intake and outlet structures, flood control overflow, the stilling basin, and power station used 0.25 million cu m steel concrete. (Gish-IVI)
W85-01861

8G. Materials

CORROSION AND PROTECTION OF PIPES IN DEVELOPING COUNTRIES,
For primary bibliographic entry see Field 8A.
W85-01991

USEFULNESS OF MEASURING THE CORROSION RATES OF SOILS (UTILITE DES MESURES DE CORROSIVITIE DES SOLS),
Naples Univ. (Italy). Facolta di Ingegneria.
M. Arpaia.
Aqua, No. 4, p 168-172, 1983. 3 Fig, 3 Tab, 19 Ref.

Descriptors: *Corrosive soils, *Pipes, *Coatings, Soil chemistry, Soil physical properties, Resistivity, Hydrogen ion concentration, Soil water, Sulfates, Chlorides, Soil bacteria.

Soil corrosivity can be a problem for buried pipes, and it is difficult to predict the corrosivity of soils based upon their physical and chemical characteristics. Soil factors which may be used to determine the corrosivity include: electrical resistivity, soil water, pH, sulfates, chlorides, sulfate and iron bacteria, and oxygen content. Different types of pipe coatings have been used to protect buried pipes, including adherent and nonadherent coatings, and passive and active coatings. Engineers can use information on the corrosivity of soils to determine what kind of protection may be necessary for water distribution networks, but there are questions as to whether getting information on soil corrosion rates is economical. (Moore-IVI)
W85-01992

CORROSION BEHAVIOUR OF CAST IRON PIPES,
Swiss Corrosion Commission, Zurich.
F. Stalder.
Aqua, No. 4, p 183-187, 1983. 9 Fig, 3 Tab, 9 Ref.

Descriptors: *Pipelines, *Corrosion, Pipes, Soil properties, Resistivity, Concrete, Gravel.

Pipelines made of grey or ductile cast iron exhibit very good corrosion resistance in soils, provided that the formation of macro-elements as a result of non-homogeneous bedding or an electrical contact with foreign cathodes or stray current effects can be avoided. Stray current effects and macro-element formation have electrochemically the same reaction mechanism. Stray current corrosion is induced by the voltage drop in the rail, whereas macro-element formation is a galvanic effect, the driving force for which stems from the corrosion potential difference. Various possibilities exist for the protection against macroelement formation, such as high-resistivity homogeneous backfill for the pipeline or the insulation of the pipeline from the soil. In the presence of foreign cathodes the high resistivity backfill provides a sure method of protection. Other methods of protection against the action of stray currents include reduction of the longitudinal conductivity as well as the drainage and forced drainage which are using the stray current as protective current for the pipeline. (Baker-IVI)
W85-01994

VARIOUS COATING MATERIALS FOR POTABLE WATER CONCRETE STORAGE RESERVOIRS - EXPERIENCES IN GERMANY, SWITZERLAND AND AUSTRIA,
Vandex Isoliermittel G.m.b.H., Hamburg (Germany, F.R.).
H. Pfundt.
Aqua, No. 5, p 235-236, 1983. 2 Fig.

Descriptors: *Water storage, *Water quality control, *Linings, *Storage reservoirs, Reservoirs, Construction, Pipelines, Coatings.

In order for water to maintain its quality during storage after treatment, the lining of reservoirs and pipes is particularly important. A coating must be waterproof, with smooth surface and good appearance, insoluble in water, and shall not contain any toxic or other harmful components, have a long life, not give rise to microbial growths, be easy to apply and be economical. Current mortar linings have advantages over other types of coatings as they contain no organic matter and there is therefore no danger from microbial growth as with organic coatings. Current slurry coatings are easy to apply but the preparation work necessary on surfaces to ensure a satisfactory result is extensive. (Baker-IVI)
W85-02000

9. MANPOWER, GRANTS AND FACILITIES

9B. Education (In-House)

WATER RESOURCES DIVISION TRAINING CATALOG,
Geological Survey, Lakewood, CO. Water Resources Div.
W. R. Hotchkiss, and L. A. Foxhoven.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Geological Survey Open-File Report 83-945, 1984. 162 p, 2 Fig, 3 Tab.

Descriptors: *Training, *Education, Water resources, *Catalogs, Training manuals, Training facilities, Federal agencies.

The National Training Center provides technical and management sessions nesessary for the conductance of the U.S. Geological Survey's training programs. This catalog describes the facilities and staff at the Lakewood Training Center and describes Water Resources Division training courses available through the center. In addition, the catalog describes the procedures for gaining admission, formulas for calculating fees, and discussion of course evaluations. (USGS)
W85-02032

9D. Grants, Contracts, and Research Act Allotments

HIGHLIGHTS OF THE 1983 FEDERAL-STATE COOPERATIVE WATER RESOURCES PROGRAM,
Geological Survey, Reston, VA. Water Resources Div.
B. K. Gilbert, and T. J. Buchanan.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 83-763, 1983. 36 p, 4 Fig, 5 Tab, 3 Ref.

Descriptors: *Water resources, *Federal-State cooperation, *Hydrologic data, State governments, Local agencies.

The U.S. Geological Survey Federal-State Cooperative Water Resources Program in fiscal year 1983 continued to concentrate on investigations of highest priority to the Nation. Hydrologic data collection and interpretive studies were underway in every State, Puerto Rico, and several U.S. territories with focus on such current concerns as ground-water contamination, floods, impacts of toxic wastes, acid precipitation, and stream quality. During the year, this 50-50 matching program was carried out in working partnership with more than 800 State, regional, and local agencies. Joint funding from all sources totaled approximately $92 million. Details of the program are mutually negotiated at the working level by representatives of the Survey and representatives of the cooperating agencies. The pooling of interests results in a balanced effort that directs combined resources to hydrologic investigations having the most significance to both parties. A few of the highlights for FY 1983, and how the program is developed with other agencies are described. (USGS)
W85-01829

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

ACTIVITIES OF THE ALASKA DISTRICT, WATER RESOURCES DIVISION, U.S. GEOLOGICAL SURVEY, 1984.
Geological Survey, Anchorage, AK. Water Resources Div.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 84-246, 1984. 34 p. Snyder, E.F., compiler.

Descriptors: Hydrology, Project planning, Bibliographies, *Alaska, *Water resources projects.

Twenty-two projects active in 1984 are described. Each description includes information on period of project, chief, funding sources, location, purpose, current status, and published or planned reports. The compilation also contains a bibliography of reports published by the Alaska Distict from 1977 through 1983. (USGS)
W85-01825

SELECTED BIBLIOGRAPHY OF WATER RESOURCES PUBLICATIONS FOR MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
G. G. Parker, Jr., D. Walker, and C. Moss.
USGS Open-File Report 84-062, 1984. 78 p, 2 Fig, 1 Tab.

Descriptors: *Bibliographies, Publications, *Mississippi.

The first edition of the Mississippi Water resources bibliography lists publications that come from a broad spectrum of sources and vary greatly in content. Many of the reports are U.S. Geological Survey publications that interpret and summarize the results, or present the basic data collected in the cooperative programs that are jointly funded with State, local, and other federal agencies. The bibliography also includes selected reports published by State and local agencies in Mississippi and adjoining states, and other federal agencies. The basic criteria used for inclusion of a publication were that the report: (1) contain data or interpretative information related to water resources or (2) the report be useful in developing additional data or interpretative studies related to water resources. To allow easy entry and retrieval, the bibliography is organized into four appendices titled Master List, Disciplines, River Basins, and Geographical Areas. (USGS)
W85-02033

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A01	$4.50	E02	7.50	T02	140.00
PAPER COPY		E03	9.50	T03	240.00
A02	7.00	E04	11.50	T04	320.00
A03	8.50	E05	13.50	T05	400.00
A04	10.00	E06	15.50	T06	465.00
A05	11.50	E07	17.50	T07	530.00
A06	13.00	E08	19.50	T08	595.00
A07	14.50	E09	21.50	T09	660.00
A08	16.00	E10	23.50	T10	725.00
A09	17.50	E11	25.50	T11	790.00
A10	19.00	E12	28.50	T12	855.00
A11	20.50	E13	31.50	T13	920.00
A12	22.00	E14	34.50	T14	985.00
A13	23.50	E15	37.50	T15	1,050.00
A14	25.00	E16	40.50	T16	1,115.00
A15	26.50	E17	43.50	T17	1,180.00
A16	28.00	E18	46.50	T18	1,245.00
A17	29.50	E19	51.50	T19	1,310.00
A18	31.00	E20	61.50	T99	**
A19	32.50	E99	**		
A20	34.00				
A21	35.50	N01	40.00		
A22	37.00	N02	40.00		
A23	38.50				
A24	40.00	*Add $1.50 for each additional 25 page increment, or portion thereof.			
A25	41.50	**Contact NTIS for price quote.			
A99	*				

PRICES EFFECTIVE JANUARY 1, 1985